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Open Science

Open Science Philosophy

Open science encompasses unrestricted access to scientific research articles, access to data from public research, and collaborative research enabled by information and communication technology tools, models, and incentives. Broadening access to scientific research publications and data is at the heart of open science. The objective of open science is to make research outputs and its potential benefits available to the entire world and in the hands of as many as possible:

- Open science promotes a more accurate verification of scientific research results. Scientific inquiry and discovery can be sped up by combining the tools of science and information technologies. Open science will benefit society and researchers by providing faster, easier, and more efficient availability of research outputs.
- Open science reduces duplication in collecting, creating, transferring, and re-using scientific material.
- Open science increases productivity in an era of tight budgets.
- Open science results in great innovation potential and increased consumer choice from public research.
- Open science promotes public trust in science. Greater citizen engagement leads to active participation in scientific experiments and data collection.

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Open Science

Open Society

An open society allows individuals to change their roles and to benefit from corresponding changes in status. Open science depends to a greater or lesser extent on digital technologies and innovations in structural processes by an open society. When realized, open science research and innovation can create investment opportunities for new and better products and services and therefore increase competitiveness and employment. Open science research and innovation is a key component of thematic open science priorities. Central to the open science digital infrastructure is enabling industry to benefit from digital technology and to underpin scientific advances through the development of an open society. Open science research and innovation can also contribute to society as a global actor because scientific relations can flourish even where global relations are strained. Open science has a critical role across many areas of decision making in providing evidence that helps understand the risks and benefits of different open science choices. Digital technology is making the conduct of open science and innovation more collaborative, more global, and more open to global citizens. Open society must embrace these changes and reinforce its position as the leading power for science, for new ideas, and for investing sustainably in the future.

It is apparent in open society that the way science works is fundamentally changing, and an equally significant transformation is taking place in how organizations and societies innovate. The advent of digital technology is making research and innovation more open, collaborative, and global. These exchanges are leading open society to develop open science and to set goals for research and innovation priority. Open science goals are materializing in the development of scientific research and innovation platforms and greater acceptance of scientific data generated by open science research. Open science research and innovation do not need help from open society to come up with great ideas, but the level of success ideas ultimately reach is undoubtedly influenced by regulation, financing, public support, and market access. Open society is playing a crucial role in improving all these success factors.

Open Science

Open science represents a new approach to the scientific process based on cooperative work and new ways of diffusing knowledge by using digital technologies and collaborative tools. These innovations capture a systemic change to the way science and research have been carried out for the last fifty years. Science is shifting from the standard practice of publishing research results in scientific publications after the research and reviews are completed. The shift is towards sharing and using all available knowledge at an earlier stage in the research process. Open science is to science what digital technology is to social and economic transactions: allowing end users to be producers of ideas, relations, and services and in doing so, enabling new working models, new social relationships and leading to a new modus operandi for science. Open science is as important and disruptive as e-commerce has been for the retail industry. Just like e-commerce, the open science research paradigm shift affects the whole business cycle of doing science and research. From the selection of research subjects to the carrying out of research, to its use and re-use, to the role of universities, and that of publishers are all dramatically changed. Just as the internet and globalization have profoundly changed the way we do business, interact socially, consume culture, and buy goods, these changes are now profoundly impacting how one does research and science.

The discussion on broadening the footprint of science and on novel ways to produce and spread knowledge gradually evolved from two global trends: Open Access and Open Source. The former refers to online, peer-reviewed scholarly outputs, which are free to read, with limited or no copyright and licensing restrictions, while open source refers to software created without any proprietary restriction and which can be accessed and freely used. Although open access became primarily associated with a particular publishing

or scientific dissemination practice, open access already sought to induce a broader practice that includes the general re-use of all kinds of research products, not just publications or data. It is only more recently that open science has coalesced into the concept of a transformed scientific practice, shifting the focus of researchers' activity from publishing as fast as possible to sharing knowledge as early as possible. Open science is defined as the idea that scientific knowledge of all kinds should be openly shared as early as is practical in the discovery process. As a result, the way science is done in the future will look significantly different from the way it is done now. Open science is the ongoing evolution in the modus operandi of doing research and organizing science. This evolution is enabled by digital technology and is driven by both the globalization of the scientific community and increasing public demand to address the societal challenges of our times. Open science entails the ongoing transitions in the way research is performed, researchers collaborate, knowledge is shared, and science is organized.

Open science impacts the entire research cycle, from the inception of research to its publication, and on how this cycle is organized. The outer circle reflects the new interconnected nature of open science, while the inner circle shows the entire scientific process, from the conceptualization of research ideas to publishing. Each step in the scientific process is linked to ongoing changes brought about by open science, including the emergence of alternative systems to establish a scientific reputation; changes in the way quality and impact of research are evaluated; the growing use of scientific blogs; open annotation; and open access to data and publications. All institutions involved in science are affected, including research organizations, research councils, and funding bodies. The trends are irreversible, and they have already grown well beyond individual projects. Theses changes predominantly result from a bottom-up process driven by a growing number of researchers who increasingly employ social media in their research and initiate globally coordinated research projects while sharing results at an early stage in the research process.

Open science is encompassed in five schools of thought:

- the infrastructure school, concerned with technological architecture
- the public school, concerned with the accessibility of knowledge creation
- the measurement school, concerned with alternative impact assessment
- the democratic school, concerned with access to knowledge
- the pragmatic school, concerned with collaborative research

According to the measurement school, the reputation and evaluation of individual researchers are still mainly based on citation-based metrics. The h-index is an author-level metric that attempts to measure both the productivity and citation impact of the publications of a scientist or scholar. The impact factor is a measure reflecting the average number of citations to articles published in an academic journal and is used as a proxy for the relative importance of a journal.

Numerous criticisms have been made of citation-based metrics, primarily when used, and often misused, to assess the performance of individual researchers. These metrics:

- are often not applicable at the individual level
- do not take into account the broader social and economic function of scientific research
- are not adapted to the increased scale of research
- cannot recognize new types of work that researchers are performing

Web-based metrics for measuring research output, popularized as altmetrics, have recently received much attention: some measure the impact at the article level, others make it possible to assess the many outcomes of research in addition to the number of scientific articles and references. The current reputation and evaluation system has to adapt to the new dynamics of open science and acknowledge and incentivize

engagement in open science. Researchers engaging in open science have growing expectations that their work, including intermediate products such as research data, will be better rewarded or taken into account in their career development. Vice-versa, the use, and reuse of open data will require appropriate codes of conduct requiring, for example, the proper acknowledgment of the original creator of the data.

These ongoing changes are progressively transforming scientific practices with innovative tools to facilitate communication, collaboration, and data analysis. Researchers that increasingly work together to create knowledge can employ online tools and create a shared space where creative conversation and collaboration can occur. As a result, the problem-solving process can be faster, and the range of problems that can be solved can be expanded. The ecosystem underpinning open science is evolving very rapidly. Social network platforms for researchers already attract millions of users and are being used to begin and validate more research projects.

Furthermore, the trends towards open access are redefining the framework conditions for science and thus have an impact on how open innovation is produced by encouraging a more dynamic circulation of knowledge. It can enable more science-based startups to emerge thanks to the exploitation of openly accessible research results. Open science, however, does not mean free science. It is essential to ensure that intellectual property is protected before making knowledge publicly available in order to subsequently attract investments that can help translate research results into innovation. If this is taken into account, fuller and broader access to scientific publications and research data can help to accelerate innovation. Investments that boost research and innovation in open science would benefit society with fewer barriers to knowledge transfer, open access to scientific research, and greater mobility of researchers. In this context, open access can help overcome the barriers that innovative organizations face in accessing the results of research funded by the public.

Open innovation

An open society is the largest producer of knowledge, but the phenomenon of open science is changing every aspect of the scientific method by becoming more open, inclusive, and interdisciplinary. Ensuring open society is at the forefront of open science means promoting open access to scientific data and publications alongside the highest standards of research integrity. There are few forces in this globe as engaging and unifying as science. The universal language of science maintains open channels of communication globally. Open society can maximize its gains through maintaining its presence at the highest level of scientific endeavor, and by promoting a competitive edge in the knowledge society of the information age. The ideas and initiatives described in this publication can stimulate anyone interested in open science research and innovation. It is designed to encourage debate and lead to new ideas on what and open society should do, should not do, or do differently.

An open society can lead to a research powerhouse; however, open society rarely succeeds in turning research into innovation and in getting research results to the global market. Open society must improve at making the most of its innovation talent, and that is where open innovation comes into play. The basic premise of open innovation is to open up the innovation process to all active players so that knowledge can circulate more freely and be transformed into products and services that create new markets while fostering a stronger culture of entrepreneurship. Open innovation is defined as the use of purposive inflows and outflows of knowledge to accelerate internal innovation. This original notion of open innovation was primarily based on transferring knowledge, expertise, and even resources from one company or research institution to another. This notion assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as they seek to improve their performance. The concept of open innovation is continually evolving and is moving from linear, bilateral transactions and collaborations

towards dynamic, networked, multi-collaborative innovation ecosystems. This means that a specific innovation can no longer be seen as the result of predefined and isolated innovation activities but rather as the outcome of a complex co-creation process involving knowledge flows across the entire economic and social environment. This co-creation takes place in different parts of the innovation ecosystem and requires knowledge exchange and absorptive capacities from all the actors involved, whether businesses, academia, financial institutions, public authorities, or citizens.

Open innovation is a broad term, which encompasses several different nuances and approaches. Two main elements underpin the most recent conceptions of open innovation: the users are in the spotlight and invention becomes an innovation only if users become a part of the value creation process. Notions such as user innovation emphasize the role of citizens and users in the innovation processes as distributed' sources of knowledge. This kind of public engagement is one of the aims of open science research and innovation. The term 'open' in these contexts has also been used as a synonym for 'user-centric'; creating a well-functioning ecosystem that allows co-creation and becomes essential for open innovation. In this ecosystem, relevant stakeholders are collaborating along and across industry and sector-specific value chains to co-create solutions for socio-economic and business challenges. One important element to keep in mind when discussing open innovation is that it cannot be defined in absolutely precise terms. It may be better to think of it as a point on a continuum where there is a range of context-dependent innovation activities at different stages, from research to development through to commercialization, and where some activities are more open than others. Open innovation is gaining momentum thanks to new large-scale trends such as digitalization and the mass participation and collaboration in innovation that it enables. The speed and scale of digitalization are accelerating and transforming the way one designs, develops, and manufactures products, the way one delivers services, and the products and services themselves. It is enabling innovative processes and new ways of doing business, introducing new cross-sector value chains and infrastructures.

Open society must ensure that it capitalizes on the benefits that these developments promise for citizens in terms of tackling societal challenges and boosting business and industry. Drawing on these trends, and with the aim of helping build an open innovation ecosystem in open society, the open society's concept of open innovation is characterized by:

- combining the power of ideas and knowledge from different actors to co-create new products and find solutions to societal needs
- creating shared economic and social value, including a citizen and user-centric approach
- capitalizing on the implications of trends such as digitalization, mass participation, and collaboration

In order to encourage the transition from linear knowledge transfer towards more dynamic knowledge circulation, experts agree that it is essential to create and support an open innovation ecosystem that facilitates the translation of knowledge into socio-economic value. In addition to the formal supply-side elements such as research skills, excellent science, funding and intellectual property management, there is also a need to concentrate on the demand side aspects of knowledge circulation, making sure that scientific work corresponds to the needs of the users and that knowledge is findable, accessible, interpretable and reusable. Open access to research results aims to make science more reliable, efficient, and responsive and is the springboard for increased innovation opportunities, e.g. by enabling more science-based startups to emerge. Prioritizing open science does not, however, automatically ensure that research results and scientific knowledge are commercialized or transformed into socio-economic value. In order for this to happen, open innovation must help to connect and exploit the results of open science and facilitate the faster translation of discoveries into societal use and economic value.

Open Science

Collaborations with global partners represent important sources of knowledge circulation. The globalization of research and innovation is not a new phenomenon, but it has intensified in the last decade, particularly in terms of collaborative research, international technology production, and worldwide mobility of researchers and innovative entrepreneurs. Global collaboration plays a significant role both in improving the competitiveness of open innovation ecosystems and in fostering new knowledge production worldwide. It ensures access to a broader set of competencies, resources, and skills wherever they are located, and it yields positive impacts in terms of scientific quality and research results. Collaboration enables global standard-setting, allows global challenges to be tackled more effectively, and facilitates participation in global value chains and new and emerging markets.

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Scholarly Research Review

The scholarly research review is a multidimensional evaluation procedure in which standard peer review models can be adapted in line with the ethos of scientific research, including accessible identities between reviewer and author, publishing review reports and enabling greater participation in the peer review process. Scholarly research review methods are employed to maintain standards of quality, improve performance, provide credibility, and determine suitability for publication. *Responsible Peer Review Procedure:* Responsible peer review ensures that scholarly research meets accepted disciplinary standards and ensures the dissemination of only relevant findings, free from bias, unwarranted claims, and unacceptable interpretations. Principles of responsible peer review:

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• Accountability in the conduct of research
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All submitted manuscripts are subject to the scholarly research review process, in which there are three stages of evaluation for consideration: pre-review manuscripts, chair-review presentation, and final-review manuscripts. All submitted full text papers, that may still be withstand the editorial review process, are presented in the conference proceedings. Manuscripts are tracked and all actions are logged by internal and external reviewers according to publication policy. External reviewers' editorial analysis consists of the evaluation reports of the conference session chairs and participants in addition to online internal and external reviewers' reports. Based on completion of the scholarly research review process, those manuscripts meeting the publication standards are published 10 days after the event date.

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Repurposing of Crystalline Solar PV for Water Glass Production

Lawal Alkasim

***Abstract*—** This work is focus on recovering silicon form photovoltaic cells and repurposing it toward the use in glass, ceramics or glass ceramics as it is made up of silicon material. Since silicon is the main back-bone and responsible for the thermodynamic properties of glass, ceramics and glass ceramics materials. Antireflection silicon is soluble in hot alkali. Successfully the recovered material composed of silicon and silicon nitride of the A.R, with small amount of silver, aluminium, lead & copper in the sunshine of crystalline/non-crystalline silicon solar cell. Aquaregia is used to remove the silver, Aluminium, lead & copper. The recovered material treated with hot alkali, 10M sodium hydroxide to produce sodium silicate, which is an alkali silicate glass (water glass). This type of glass is produced through chemical process, unlike other glasses that are produced through physical process of melting and non-crystalline solidification. It has showed a property of being alkali silicate glass from its solubility in water and insoluble in alcohol. While the FTIR gave us wave number of 3362.1cm-1/52.717 transmittance for the sodium silicate (Na2SiO3) and wave number of 3400cm-1/4300 transmittance for silicon-oxygen bond in liquid silica gel.

***Keywords*—** crystalline solar PV, water glass, repurposing, waste management.

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Superchaotropicity : Grafted Surface to Probe the Adsorption of Nano-Ions

Raimoana Frogier, Luc Girard, Pierre Bauduin, Diane Rebiscoul and Olivier Diat

***Abstract*—** Nano-ions (NIs) are ionic species or clusters of nanometric size. Their low charge density and the delocalization of their charges give special properties to some of NIs belonging to chemical classes of polyoxometalates (POMs) or boron clusters. They have the particularity of interacting non-covalently with neutral hydrated surface or interfaces such as assemblies of surface-active molecules (micelles, vesicles, lyotropic liquid crystals), foam bubbles or emulsion droplets. This makes possible to classify those NIs in the Hofmeister series as superchaotropic ions. The mechanism of adsorption is complex, linked to the simultaneous dehydration of the ion and the molecule or supramolecular assembly with which it can interact, all with an enthalpic gain on the free energy of the system. This interaction process is reversible and is sufficiently pronounced to induce changes in molecular and supramolecular shape or conformation, phase transitions in the liquid phase, all at sub-millimolar ionic concentrations. This new property of some NIs opens up new possibilities for applications in fields as varied as biochemistry for solubilization, recovery of metals of interest by foams in the form of NIs... In order to better understand the physico-chemical mechanisms at the origin of this interaction, we use silicon wafers functionalized by non-ionic oligomers (polyethylene glycol chains or PEG) to study in situ by X-ray reflectivity this interaction of NIs with the grafted chains. This study carried out at ESRF (European Synchrotron Radiation Facility) and has shown that the adsorption of the NIs, such as POMs, has a very fast kinetics. Moreover the distribution of the NIs in the grafted PEG chain layer was quantify. These results are very encouraging and confirm what has been observed on soft interfaces such as micelles or foams. The possibility to play on the density, length and chemical nature of the grafted chains makes this system an ideal tool to provide kinetic and thermodynamic information to decipher the complex mechanisms at the origin of this adsorption.

***Keywords*—**adsorption, nano-ions, solid-liquid interface, superchaotropicity.

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Development of Deep Neural Network-based Strain Values Prediction Models for Full-Scale reinforced concrete Frames Using Highly Flexible Sensing Sheets

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Abstract

Structural Health monitoring systems (SHM) are commonly used to identify and assess structural damage. In terms of damage detection, SHM needs to periodically collect data from sensors placed in the structure as damage-sensitive features. This includes abnormal changes caused by the strain field and abnormal symptoms of the structure, such as damage and deterioration. Currently, deploying sensors on a large scale in a building structure is a challenge. In this study, a highly stretchable strain sensors are used in this study to collect data sets of strain generated on the surface of full-size reinforced concrete (RC) frames under extreme cyclic load application. This sensing sheet can be switched freely between the test bending strain and the axial strain to achieve two different configurations. On this basis, the deep neural network prediction model of the frame beam and frame column is established. The training results show that the method can accurately predict the strain value and has good generalization ability. The two deep neural network prediction models will also be deployed in the SHM system in the future as part of the intelligent strain sensor system.

Keywords: Strain Sensing Sheets, Deep Neural Networks, Strain measurement, SHM system, RC Frames.

Digital Twin for University Campus: Workflow, Applications and Benefits

Frederico Fialho Teixeira, Islam Mashaly, Maryam Shafiei, Jurij Karlovsek

***Abstract*—** The ubiquity of data gathering and smart technologies, advancements in virtual technologies, and the development of the internet of things (IoT) have created urgent demands for the development of frameworks and efficient workflows for data collection, visualisation, and analysis. Digital twin, in different scales of the city into the building, allows for bringing together data from different sources to generate fundamental and illuminating insights for the management of current facilities and the lifecycle of amenities as well as improvement of the performance of current and future designs. Over the past two decades, there has been growing interest in the topic of digital twin and their applications in city and building scales. Most such studies look at the urban environment through a homogeneous or generalist lens and lack specificity in particular characteristics or identities, which define an urban university campus. Bridging this knowledge gap, this paper offers a framework for developing a digital twin for a university campus that, with some modifications, could provide insights for any large-scale digital twin settings like towns and cities. It showcases how currently unused data could be purposefully combined, interpolated and visualised for producing analysis-ready data (such as flood or energy simulations or functional and occupancy maps), highlighting the potential applications of such a framework for campus planning and policymaking. The research integrates campus-level data layers into one spatial information repository and casts light on critical data clusters for the digital twin at the campus level. The paper also seeks to raise insightful and directive questions on how digital twin for campus can be extrapolated to city-scale digital twin. The outcomes of the paper, thus, inform future projects for the development of large-scale digital twin as well as urban and architectural researchers on potential applications of digital twin in future design, management, and sustainable planning, to predict problems, calculate risks, decrease management costs, and improve performance.

***Keywords*—** digital twin, smart campus, framework, data collection, point cloud.

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Influence of Thermal Ageing Time on Space Charge in Inhomogeneous Insulations of Dc Cable Joints

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Abstract

This paper presents a study on the influence of the ageing time of bi-layer insulations (unaged and thermally aged) on the values of the accumulated volume and surface space charge and the distribution of the electric field (especially the residual field). The bi-layer samples were manufactured from XLPE and EPR or EPDM and were thermally aged up to 60 days at 120ºC. It is shown that a volume charge density accumulates in the bulk of the sample, more in the layer connected to the HV electrode, and that its variation depends on the ageing time. Space charge also accumulates at the interface between the two dielectric layers, with a negative polarity under applied voltage and becoming positive after de-energization, more as the sample is thermally aged. The variation of the average charge density value was also analyzed, and it was found that it increases with the ageing time and is up to 3 times higher in XLPE/EPDM than in XLPE/EPR samples. The space charge changes the distribution of the electric field under applied voltage, the field becoming locally up to 5-7 times more intense than its average value. Finally, it is shown that the increase of the ageing time leads to the increase of the values of the average density of the remaining space charge (and, respectively, of the remaining electric field) in all the samples, which remains at significant levels even after 600s.

Keywords: DC cable joints, XLPE / EPR insulation, XLPE / EPDM insulation, Thermal ageing, Space charge, Electric field.

1. Introduction

High-voltage direct-current (HVDC) power transmission is the most powerful application for line-commutated converters that exist today. There are power converters with ratings in excess of 1000 MW. In high-power and long-distance applications, these systems become more economical than conventional *ac* systems. They also have some other advantages compared with AC systems: they can link two AC systems operating unsynchronized or with different nominal frequencies, they have very good dynamic behaviour and can interrupt short-circuit problems very quickly. If transmission is by submarine or underground cable, it is not practical to consider *ac* cable systems exceeding 50 km, but *dc* cable transmission systems are in service whose length is in hundreds of kilometres and even distances of 600 km or greater have been considered feasible [1]. However, the cost of the substation equipment needed to convert DC electricity back to AC at both ends of the transmission line is expensive. Since the initial cost can be prohibitive, HVDC transmission is usually only preferred for long distances. Over their lifetime, long-distance transmission lines can save operators money because of their efficiency.

The cable joints are used to connect low, medium or high voltage cables. The type of cable joint sizes, shapes and configurations vary according to the voltage, structure, insulation and the number of cores of the cable to be jointed. The joints provide electrical insulation as well as mechanical protection and strength. The electrical connection is made in various ways and can crimping, or use of mechanical connectors, soldering, etc.

The body of a typical HVDC joints is made of three insulating or semiconducting layers, i.e. [2]) (Fig. 1): 1) conducting inner deflector, made of semiconducting rubber, acting as electrode and electric screen of the connector; 2) main insulation, made of insulating rubber; 3) conducting outer deflector/ screen, made of semiconducting rubber, acting as earth electrode. An alternative field grading solution used to reduce the local enhancements of the electric field is by applying a layer of nonlinear resistive Field Grading Materials (FGMs) (Fig. 1) [3] – [4].

Silicone rubber (SiR) and Ethylene-propylene-diene-monomer (EPDM) are the two most-common materials for the main insulation of pre-moulded joints. For HVDC joints, EPDM is mainly used, since – due to its lower volume resistivity related to its more complex and compounded terpolymer structure – it reduces space charge accumulation in HVDC joints especially at higher voltage levels and at dielectric interfaces [5].

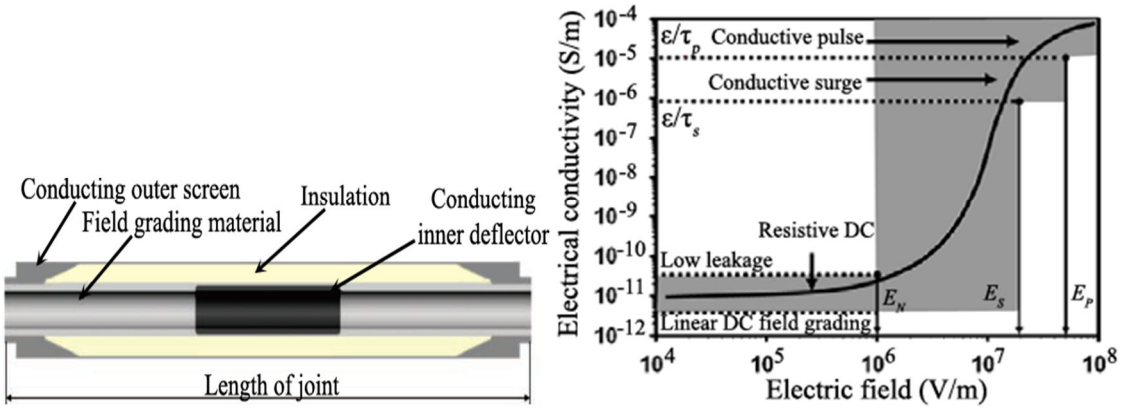

Fig. 1. Typical design for HVDC joints (a) and FGM conductivity (b) [2]

The problems of DC transmission is the accumulation of space charge, both in the bulk of the insulation and at the cable-joint insulations interface. Challenges remain for XLPE based HVDC cable insulation owning to the issues related to space charge possibly arising from the low charge mobility and high trapping rates [6, 7]. It has been reported that pure XLPE revealed substantial heterocharge accumulation [8]. For the cable-joint interface, the Maxwell-Wagner-Sillars [9] model offers an adequate explanation of the charge accumulation phenomenon at the interface, showing that the accumulated charge is proportional to the ratio between the permittivity and conductivity of the two layers adjacent to the interface. This ratio depends on the temperature, so any change in cable load leads to the modification of the interface charge values and of the distribution of the electric field. For a bi-layer flat sample geometry, the Maxwell-Wagner-Sillars eq. can be written as follows [10]:

$$\rho_s(t) = \frac{\varepsilon_1\sigma_2 - \varepsilon_2\sigma_1}{\sigma_1 g_2 + \sigma_2 g_1} U\left[1 - \exp\left(-\frac{t}{\tau_{12}}\right)\right], \quad (1)$$

where g_1 and g_2 represent the thicknesses, σ_1 and σ_2 – the DC conductivities and $\varepsilon_1 = \varepsilon_0.\varepsilon_{r1}$ and $\varepsilon_2 = \varepsilon_0.\varepsilon_{r2}$ – the permittivities of the layers 1 and 2, $\varepsilon_0 = 8.85.10^{-12}$ F/m – vacuum permittivity and τ_{12} – the charge relaxation time:

$$\tau_{12} = \frac{g_1\varepsilon_2 + g_2\varepsilon_1}{g_1\sigma_2 + g_2\sigma_1}. \quad (2)$$

As shown in (1), the values of $\rho_s(t)$ depend on the values of conductivities and permittivities of layers 1 and 2, whose magnitudes are influenced by the temperature and electric field values. As the phenomenon of electrical conduction in polymeric materials depends on both the value of the electric field and the temperature, a series of empirical models have been developed for determining the electrical conductivity, considering a variation only with temperature ($\sigma = f(T)$ [11]), only with the electric field ($\sigma = f(E)$ [12]) or with both parameters ($\sigma = f(T,E)$) [13].

Thermal ageing of materials causes physical, chemical and micro-structural deformations and leads to the formation of free radicals which, through successive reactions, lead to the fracture of molecular chains and the appearance of oxidation products (such as carbonyl and hydroxyl groups, unsaturated groups or acid groups grafted on the molecular chain) [14] – [15], leading to a reduction of mechanical properties, reduction of dielectric strength and electrical resistivity, an increase of the loss factor and space charge in the bulk of the insulation [14] and an increase in trap density and a consequent increase in trapped charge density [16].

Space charge measurements on full size joints has inherent difficulties relevant to: *a*) the huge thickness of joint insulation, which leads to a dramatic attenuation of SC related signal; *b*) the complexity of joint insulation and overall structure; 3) the hard access to joint insulation for installing measurement cells. Thus, so far such measurements are mainly done on flat specimens or on small-size cables with a multi-layer insulation that simulates the much thicker and complex insulation of joints [2], [10], [17]-[19].

There are numerous researches regarding the measurement and computation of the space charge on bi-layer insulation samples of XLPE / EPR [10], XLPE / rubber [20], XLPE / EPR joint models [21-23] using bipolar charge transport equations [21]-[22], respectively a model developed on conductivity values [23], in varying time regime or steady state, in the absence or presence of FGM (field grading materials) [24]. Space charge measurements reveal the presence of interfacial charge in multi-dielectric, whose strength and sign depend on temperature and field.

The effect of thermal ageing on space charge in bi-layer insulations or joint models is little presented in the literature, and usually not on XLPE / rubber materials such as those generally used for the manufacturing of real cable joints for polymeric insulated cables [25].

This paper presents a study on the influence of the ageing time of bi-layer insulation XLPE / EPR and XLPE / EPDM (unaged and thermally aged) on the values of the accumulated volume and surface space charge and the distribution of the electric field (especially the residual field).

2. Experiments

2.1. Samples

The flat samples that represent models of DC cable joint insulations were manufactured in the R&D Laboratory of ICME ECAB, Romania, on a GIBITRE Instruments laboratory press. The primary materials were low density polyethylene pellets and strips of unvulcanised Ethylene-propylene and Ethylene-propylene-diene monomer rubbers. Both XLPE / EPR and XLPE / EPDM bi-layered samples have a thickness of $g = 0.80$ mm (Fig. 2).

In order to reduce the content of by-products resulting from the technological manufacturing processes, all the samples were subjected to a thermal conditioning of 48 h at a temperature of 50 °C.

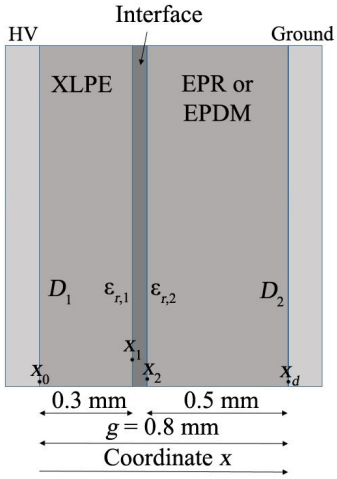

Fig. 2. Schematic representation of the XLPE / EPR (EPDM) sample

2.2. Space charge measurement

The determination of space charge density was performed using the PEA method, at LIMES of the University of Bologna, Italy. The PEA method allows the determination of the space charge density distribution in flat and cylindrical samples, on cables or on cable joints. A detailed presentation of these systems can be found in [26-27].

In the case of multi-layered samples, due to the different acoustic properties for each material, there is an acoustic impedance mismatch at the interfaces and the electroacoustic wave suffers a reflection in its propagation to the sensor. Depending on the sample geometry, the reflected signal can overlap the measured signal area – so special care must be taken when performing space charge measurements on multi-layered samples in order to identify any reflected signal overlap [13, 16].

The space charge density determination can be performed under voltage (Voltage-ON) or after the removal of the voltage (Voltage-OFF).

During the Voltage-ON measurement, the sample to be measured is in an electric field produced by the voltage applied by the high voltage source, and the pulse generator transmits electrical pulses to the sample. These pulses are captured by an oscilloscope and are subsequently recorded. For the measurement under Voltage-OFF the power supply does not output any voltage and the signal acquired by the oscilloscope is proportional to the density of the space charge present in the sample.

3. Computation of charge density

3.1. Surface charge density

The surface charge density ρ_s at the interface between the two layers of a sample has been determined from the volume charge density ρ_v [13]:

$$\rho_s\left(x_{\text{interface}}\right) = \frac{\int_{x_1}^{x_2} \rho_v(x)dx}{x_{\text{interface}}} \tag{3}$$

where $x_{interface}$ represents the position of the interface, x_1 and x_2 represent the values of the coordinate x that characterize the thickness of the interface (Fig. 2).

3.2. Average charge density

The average charge density $\rho_{v,avg}$, also called the residual charge or stored charge, is the arithmetic mean of the difference between the space charge density ρ_v accumulated in the sample at a moment t after the removal of the voltage and the space charge density value registered immediately after the removal of the voltage. It has the following expression [28]:

$$\rho_{v,avg}(t, Voff) = \frac{1}{x_d - x_0 - 2x_\delta} \left[\int_{x_0+x_\delta}^{x_d-x_\delta} \left(|\rho_v(t, Voff)| - |\rho_v(t_0, Voff)| \right) dx \right] \quad (4)$$

where $t_{0,Voff}$ represents a moment at the beginning of the Voltage-OFF procedure, $t_{,Voff}$ represents a moment of the signal acquisition in the measurement mode Voltage-OFF, x_0 and x_d represent the coordinate positions of the HV and Ground electrodes (Fig. 2) and x_δ represents a distance equal to 3 % of the sample thickness, used to exclude from the calculations the values in the immediate vicinity of both electrodes (induced charges at the electrodes are not taken into account). The values of the charge densities ρ_v are considered in absolute values.

4. Computation of the electric field

The electric field was determined along the spatial coordinate x corresponding to the thickness of the sample (see Fig. 2) in a domain $D_{tot} = D_1 \cup D_2$ which is linear, isotropic and inhomogeneous. Considering the Electrostatics regime and eqs. (5) – (7) has resulted in eq. (8) that was used to compute the electric field spatial distribution.

$$\overline{D}(P) = \varepsilon(P) \cdot \overline{E}(P) \quad , \quad P \in D_{tot} \quad (5)$$

$$\mathrm{div}\left(\overline{D}(P)\right) = \rho_v(P) \quad , \quad P \in D_{tot} \quad (6)$$

$$\overline{E}(P) = -\mathrm{grad}\left(V(P)\right) \quad , \quad P \in D_{tot} \quad (7)$$

$$E(P) = \int_{x_0}^{P} \rho_v(x)\,\mathrm{d}x \Big/ \varepsilon(P) \quad , \quad P \in D_{tot} \quad (8)$$

where D represents the electric displacement field, E is the electric field, V is the electric potential, $\varepsilon = \varepsilon_0 \cdot \varepsilon_r$ is the electric permittivity, ε_0 is the vacuum permittivity and ε_r is the relative permittivity at point P in the domain D_{tot}.

The relative permittivities ε_r of the two layers were determined from dielectric spectroscopy measurements using a NOVOCONTROL Alpha A Analyzer. The values of ε_r (at f = 50 Hz) are presented in Table 1 [13].

Table 1. Variation of the relative permittivity with the ageing time, for XLPE, EPR and EPDM samples (f = 50 Hz, T = 30 °C)

	Material		
Ageing	XLPE	EPR	EPDM
Unaged (I0)	2.30	2.80	3.15
Aged 30 days (I1)	2.25	2.85	2.55
Aged 60 days (I2)	2.20	3.60	2.65

5. Results and discussion

5.1. Optical microscopy

Figure 3 shows the interface of an XLPE / EPR unaged sample realized by optical microscopy at a 40 X magnification. It is observed that the interface is relatively smooth, respectively, at the macroscopic level, there are no open pores, craters etc. From the measurements performed, the thickness of the interface resulted in approximately 0.5 μm.

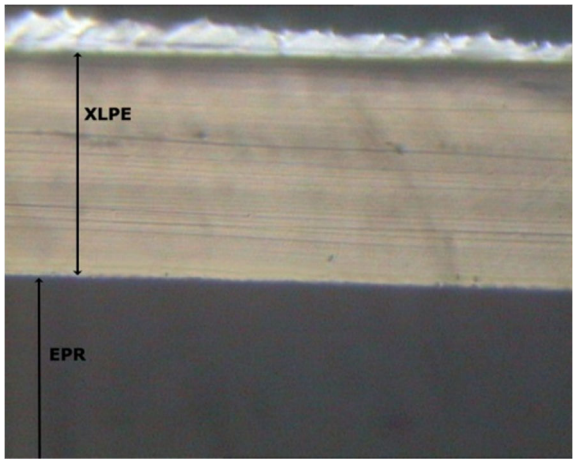

Fig. 3. Interface area of a XLPE / EPR unaged sample

5.2. Thermal ageing

The ageing temperature of samples was 120 °C (after DSC determination of the melting temperature, Fig. 4), and the ageing times were 30 and 60 days. The measurements were performed for all samples at 48 hours after removal from the laboratory oven.

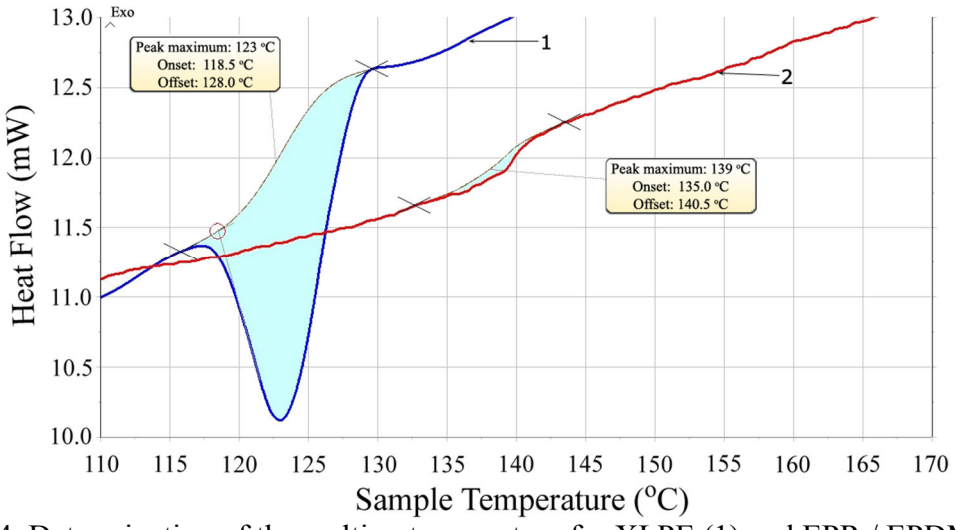

Fig. 4. Determination of the melting temperature for XLPE (1) and EPR / EPDM (2)

5.3. Space charge

Space charge measurements were performed for samples subjected to 3600 s under voltage, followed by 3600 s after voltage cancellation. The applied voltage U_{app} ranged between 4 and 16 kV and the applied electric field between 5 and 20 kV/mm.

5.3.1. Space charge density

Figure 5 shows the spatial distribution of the space charge density, measured on unaged XLPE / EPR samples (I0) and thermally aged for 30 days (I1) and 60 days (I2), after t = 3600 s from the application of a voltage U_{app} = 4 kV (Voltage-ON). It can be seen that the space charge is accumulated in the entire thickness of the sample, more in the layer next to the HV electrode (in XLPE, respectively) and, has, generally negative polarity.

After the removal of the voltage (Voltage-OFF) the space charge density doesn't cancel immediately (Fig. 6), but its distribution changes slightly, especially in the layer connected to the Ground electrode (EPR). In this layer, more positive charge is separated, and in the vicinity of the interface and at the Ground electrode peaks of positive charge appear, especially in the 30-day old samples (Fig. 6, curve 2).

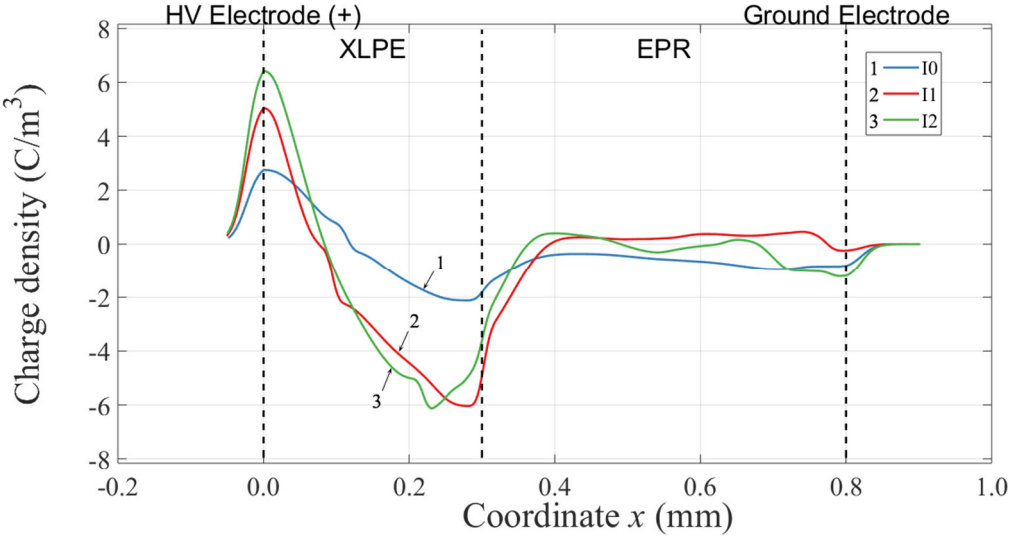

Fig. 5. Variation of the space charge density with the coordinate x, at an hour after voltage application, for unaged (I0, **1**) and aged for 30 days (I1, **2**) and 60 days (I2, **3**) XLPE / EPR samples (t = 3600 s, U_{app} = 4 kV, Voltage-ON)

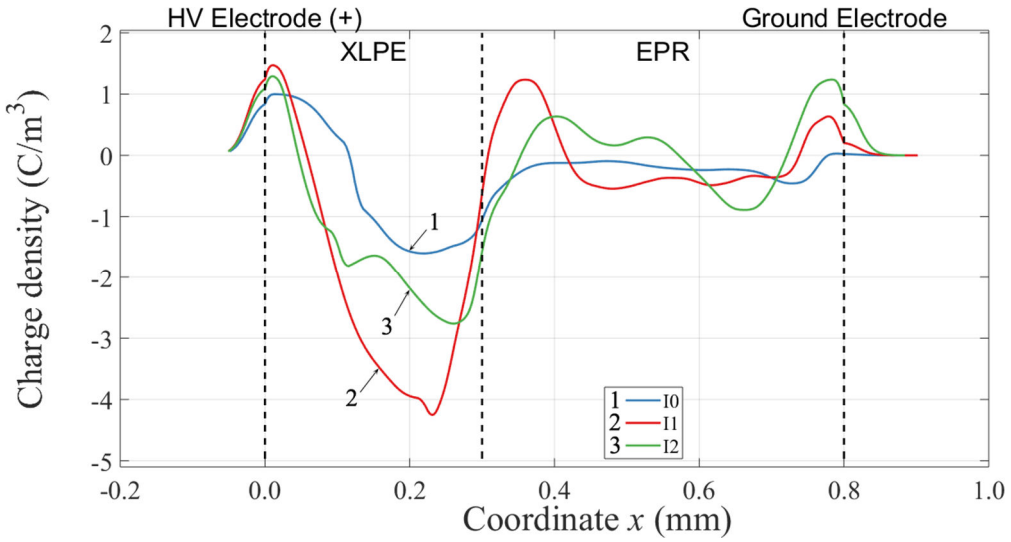

Fig. 6. Variation of the space charge density with the coordinate x,

at 60 s after removing the voltage, for unaged (I0, **1**) and aged for 30 days (I1, **2**) and 60 days (I2, **3**) XLPE / EPR samples (t = 60 s, U_{app} = 4 kV, Voltage-OFF)

5.3.2. Average charge density

Figure 7 shows the time variation of the average charge density $\rho_{v,avg}$ in unaged and aged (30 and 60 days) XLPE / EPR samples after voltage removal. In can be seen that the increase of the ageing duration determines an increase of the average charge density values (Fig. 7, curves 2 and 3).

On the other hand, in all samples, the average charge density decreases over time, faster in the first 30 minutes, and stabilizing in time to a quasi-constant value. This decrease is more important in the unaged samples (Fig. 7, curve 1) than in the aged ones (Fig. 9, curves 2 and 3). Thus, after 30 minutes, $\rho_{v,avg}$ decreases by 80 % in the unaged samples and only by 50 % in the 60-days aged sample (Fig. 7).

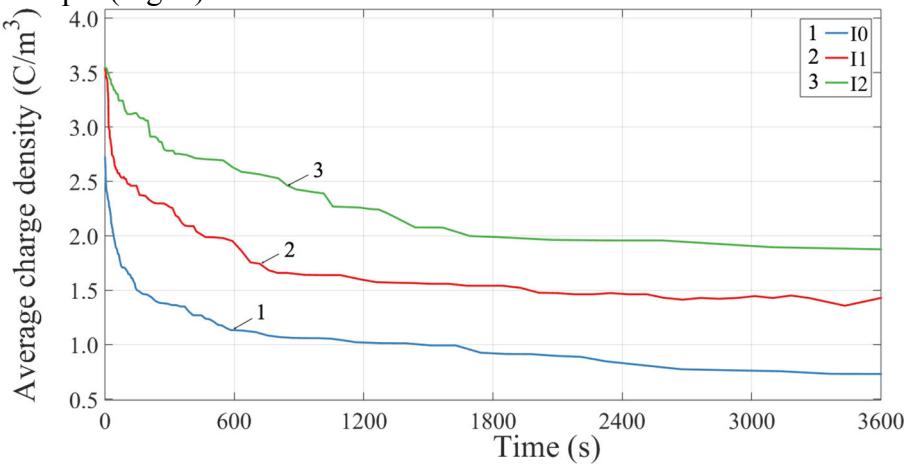

Fig. 7. Variation of the average charge density value with the measurement time, for unaged (I0, **1**) and aged for 30 days (I1, **2**) and 60 days (I2, **3**) XLPE / EPR samples (U_{app} = 8 kV, Voltage-OFF)

Figure 8 shows the variation with the ageing duration of the average charge density obtained at 60 s after Voltage-OFF, for the XLPE / EPR samples (Fig. 8, curve 1) and XLPE / EPDM (Fig. 8, curve 2). It can be seen that the nature of the sample influences the rate of increase of the $\rho_{v,avg}$ values, more significantly for XLPE / EPDM than for XLPE / EPR samples. For example, after 60 days of ageing, the value of $\rho_{v,avg}$ increased by 180 % for XLPE / EPR samples and with 225 % for XLPE / EPDM samples.

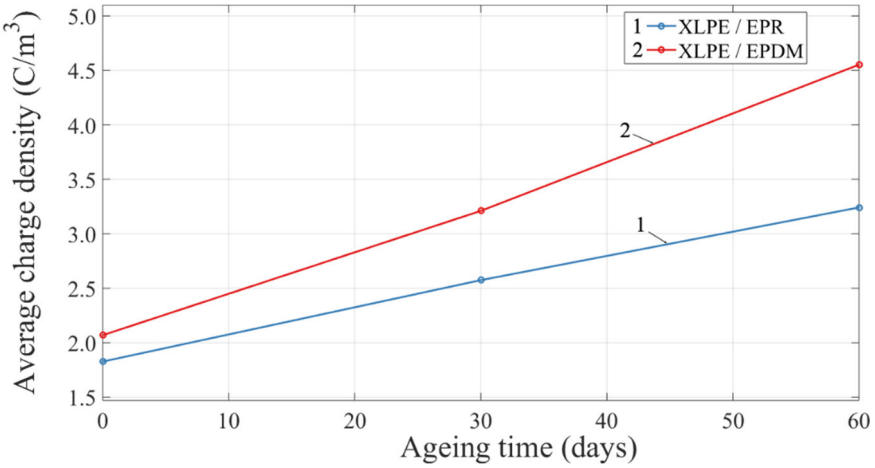

Fig. 8. Variation of the average charge density value with the ageing time, for XLPE / EPR (**1**) and XLPE / EPDM (**2**) samples (t = 60 s, U_{app} = 8 kV, Voltage-OFF)

5.3.3. Surface charge density

Figures 9 and 10 show the variations in time of the surface charge density ρ_s, for unaged samples (I0) and aged for 30 days (I1) and 60 days (I2).

In the presence of voltage (Voltage-ON) the surface charge density has negative values in all samples. In the first 1800 s the values of ρ_s increase in time in all samples, slower in the unaged samples and faster in the aged ones. After approx. 2400 s the values of ρ_s stabilize (Fig. 9). In the case of the 30-days aged samples, however, there is an increase in the values of ρ_s only in the first 1200 s, then a decrease continuing up to 2400 s, after which the values of ρ_s stabilize (Fig. 9, curve 2).

After voltage removal (Voltage-OFF) there is a decrease in the values of ρ_s and a change of sign in its values (Fig. 10), becoming positive. This is followed by an increase in positive values and a stabilization after a time which is dependent on the ageing state of the sample. Thus, in the case of the samples aged for 30 days, the sign change is after about 3 minutes and the values of ρ_s stabilize after 10 minutes (Fig. 10, curve 2), while in the samples aged for 60 days the sign change is after approx. 12 minutes and the stabilization after approx. 50 minutes (Fig. 10, curve 3). In the case of the unaged samples the values of ρ_s remain negative and tend towards 0 (Fig. 10, curve 1).

It should be noted that, in the case of aged samples, after the removal of the voltage, the surface charge density still retains important values (Fig. 10, curves 2 and 3).

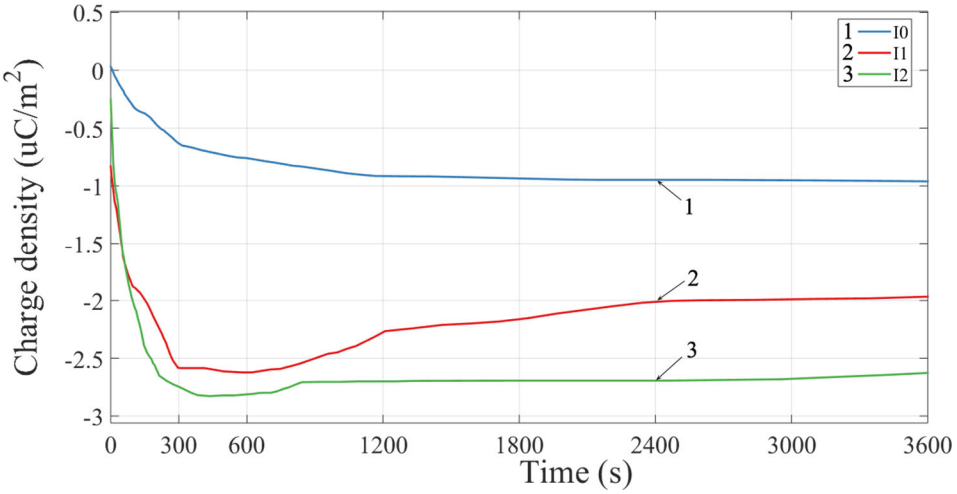

Fig. 9.Variation of the surface charge density with the measurement time during voltage application, at a point $P(x_P)$ at the interface of unaged (I0, **1**) and aged for 30 days (I1, **2**) and 60 days (I2, **3**) XLPE / EPR samples (x_P = 0.30 mm, U_{app} = 4 kV, Voltage-ON)

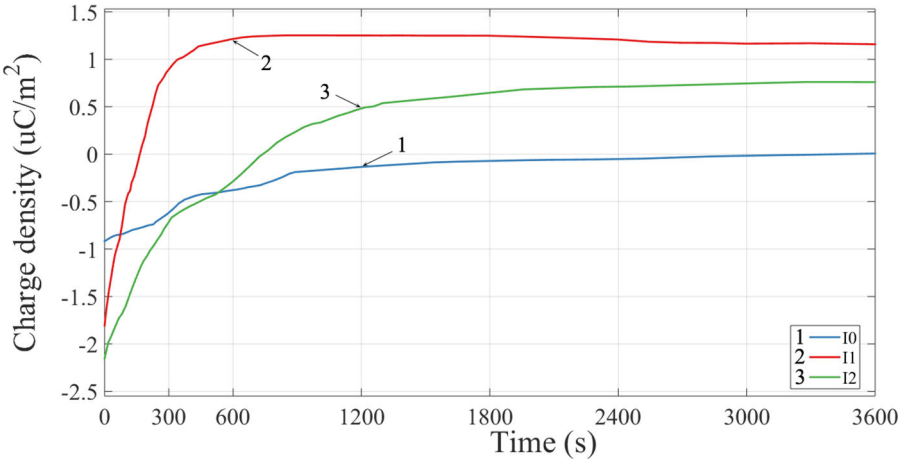

Fig. 10. Variation of the surface charge density with the measurement time after removing the voltage, at a point $P(x_P)$ at the interface of unaged (I0, **1**) and aged for 30 days (I1, **2**) and 60 days (I2, **3**) XLPE / EPR samples (x_P = 0.30 mm, U_{app} = 4 kV, Voltage-OFF)

5.4. Electric field

The variation in time of the values of the electric field, for unaged and aged samples, are presented in Figure 11 (Voltage-ON) and Voltage-OFF (Figure 12). The values of the electric field E are influenced by the space charge present in the samples and by the ageing time for the samples, both in the presence (Fig. 11) and in the absence (Fig. 12) of applied voltage. During Voltage-ON (U_{app} = 4 kV) and due to the distribution of space charge in the bulk and at the interface, the electric field has a maximum which increases in value in the first 1200 s and then remains quasi-constant until the end of the measurement time. At 3600 s, the maximum value of the electric field is 19 kV/mm for the unaged samples (Fig. 11, curve 1), 31 kV/mm for the samples aged for 30 days (Fig. 11, curve 2) and 35 kV/mm for the samples aged for 60 days

(Fig. 11, curve 3). The maximum values of *E* are higher in the aged samples (Figure 11, curves 2 and 3) than in the unaged samples (Fig. 11, curve 1).

After removing the voltage, there is a residual electric field inside the sample, generated by the space charge present in the bulk and at the interface of the sample. The value of the residual electric field is higher near both of the electrodes than in the bulk of the sample, and is highest in the aged samples (Fig. 12, curves 2 and 3) than in the unaged samples (Fig. 12, curve 1). This is probably due to the higher values of the concentration of charge carriers (respectively, on the space charge density values) resulted from the ageing process.

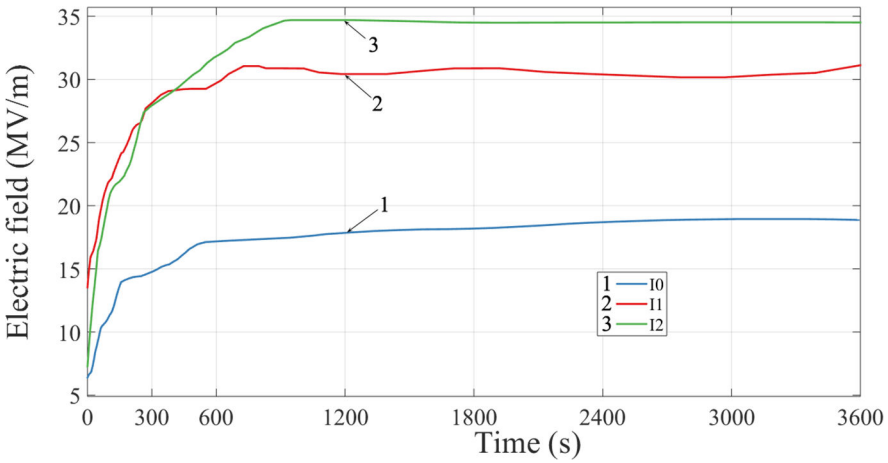

Fig. 11. Variation of the maximum value of the electric field at different measurement times during voltage application, for unaged (I0, **1**) and aged for 30 days (I1, **2**) and 60 days (I2, **3**) XLPE / EPR samples (Voltage-ON, U_{app} = 4 kV)

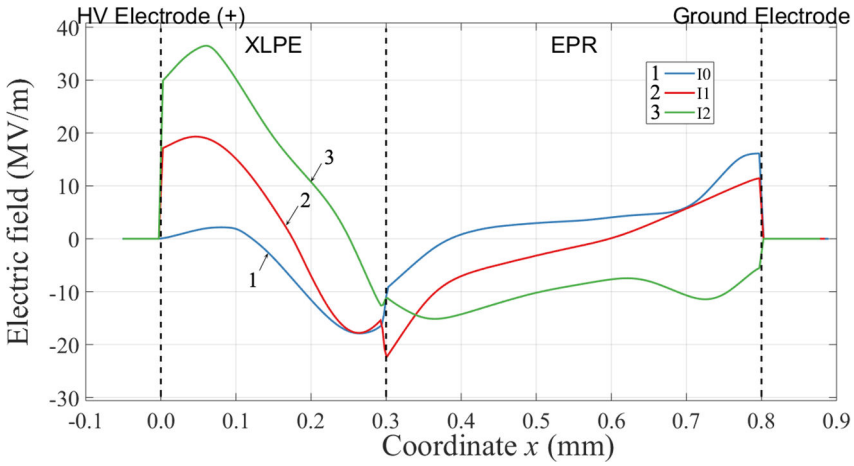

Fig. 12. Variation of the residual electric field with the coordinate *x* at 600 s after removing the voltage, for unaged (I0, **1**) and aged for 30 days (I1, **2**) and 60 days (I2, **3**) XLPE / EPR samples (t = 600 s, Voltage-OFF, U_{app} = 8 kV)

6. Conclusions

This paper studied the influence of thermal ageing on space charge in two types of inhomogeneous polymeric samples (XLPE / EPR and XLPE / EPDM) representing DC cable joint insulations. Thermal ageing time has led to the increase in space charge density in the bulk

of samples. This increase is more important in the layer connected to the HV source (XLPE), where the space charge is of negative polarity.

The space charge also accumulates at the interface between the insulation layers, where it is of negative polarity, increases rapidly in the first 10 minutes after the application of the voltage and remains constant for unaged samples and decreases slightly with the measurement time for aged samples. Over time, after the voltage is removed, charge of positive polarity accumulates at the interface, which stabilizes towards constant non-zero values.

The values of the average charge density increase with the duration of ageing for both types of samples. The values depend on the nature of the sample, and, for the samples aged for 60 days, are 40 % higher for XLPE / EPDM than for XLPE / EPR samples.

The distribution in time of the average charge density after the removal of voltage shows that the space charge is not cancelled even after 3600 s have elapsed. The value of this residual charge present is 3 times higher for the XLPE / EPR samples aged for 60 days than for the unaged samples.

Under applied voltage, the accumulated space charge enhances the maximum values of the electric field. This increase depends on the ageing time and reaches locally up to 5 – 7 times over the average electric field value. After the removal of voltage, the residual space charge generates a residual electric field, which can be a real danger for those who perform repair or maintenance work on the de-energized DC cables and joints. The residual electric field remains at significant levels at 600 s after de-energization, especially for aged samples.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Investigating Factors Influencing Generation Z's Pro-Environmental Behavior to Support the Energy Transition in Jakarta, Indonesia

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***Abstract*—** The energy transition is crucial for mitigating climate change and achieving sustainable development and resilience. As the energy transition advances, generation Z is entering the economic world and will soon be responsible for taking care of the environment. This study aims to investigate the factors influencing generation Z's pro-environmental behavior to support the energy transition. The theory of planned behavior approach was combined with the pro-environmental behavior concept to examine generation Z's support toward the energy transition through participating in activism, using energy from renewable sources, opting for energy-efficient utilities or vehicles, and influencing others. Data were collected through an online questionnaire of 400 respondents aged 18-26 living in Jakarta, Indonesia. Partial least square structural equation modeling (PLS-SEM) using SmartPLS 3.0 software was used to analyze the reliability and validity of the measurement model. The results show that attitude, subjective norms, and perceived behavior control positively correlate with generation Z's pro-environmental behavior to support the energy transition. This finding could enhance understanding and provide insights to formulate effective strategies and policies to increase generation Z's support towards the energy transition. This study contributes to the energy transition discussion as it is included in the Sustainable Development Goals, as well as pro-environmental behavior and theory of planned behavior literature.

***Keywords*—.**Energy transition, pro-environmental behavior, theory of planned behavior, generation Z.

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The Effectiveness of Energy-related Tax in Curbing Transport-related Carbon Emissions: The Role of Green Finance and Technology in OECD Economies

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***Abstract*—** Being responsible for the largest source of energy-related emissions, the transportation sector is driven by more than half of global oil demand and total energy consumption, making it a crucial factor in tackling climate change and environmental degradation. The present study empirically tests the effectives of the energy-related tax (TXEN) in curbing transport-related carbon emissions (CO2TRANSP) in Organization for Economic Cooperation and Development (OECD) economies over the period of 1990-2020. Moreover, Green Finance (GF), Technology (TECH), and Gross domestic product (GDP) have also been added as explanatory factors which might affect CO2TRANSP emissions. The study employs the Method of Moment Quantile Regression (MMQR), an advance econometric technique to observe the variations along each quantile. Based on the results of the preliminary test, we confirm the presence of cross-sectional dependence and slope heterogeneity. Whereas the result of the panel unit root test report mixed order of variables' integration. The findings reveal that rise in income level activates CO2TRANSP, confirming the first stage of Environmental Kuznet Hypothesis. Surprisingly, the present TXEN policies of OECD member states are not mature enough to tackle the CO2TRANSP emissions. However, the findings confirm that GF and TECH are solely responsible for the reduction in the CO2TRANSP. The outcomes of Bootstrap Quantile Regression (BSQR) further validate and support the earlier findings of MMQR. Based on the findings of this study, it is revealed that the current TXEN policies are too moderate, and an incremental and progressive rise in TXEN may help in a transition toward a cleaner and sustainable transportation sector in the study region.

***Keywords*—** transport-related CO2 emissions, energy-related tax, green finance, technological development, oecd member states.

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On a Strategy of Mobile Network Synthesis

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***Abstract*— E**ffective design of mobile communication network includes optimization of two bounded together processes: the network base stations placement and the channel assignment. In real environments the well-known cellular concept fails due to not uniformly spaced traffic and not isotropic wave propagation. We find a rather universal method for synthesis of a close to optimal network structure. The proposed design approach is based on the idea of adaptive vector quantization for a map with random traffic. As a result, the service zone of the network becomes discrete and is being transformed to a map with not equal cells and approximately equal number of requests in every one. This fact allows to apply the simplest periodic reuse pattern. The algorithm finds a point with minimal average Euclidean distance from all its requests. This point defines optimal placement of the corresponding base station. The approach guarantees maximum coverage.

***Keywords*—** mobile networks synthesis, markovmodels, fading models, wireless channels models

1. Introduction

Mobile radio networks operating nowadays have been designed with the help of the well-known cellular concept. It considers the space structure of the network as a regular hexagonal cell lattice with a periodic frequency reuse pattern [1, 2]. This design strategy is widely accepted as it provides the most economic covering of the service area, the densest packing of co-channel cells and is relatively simple. Except for cell splitting [3], no other theoretical solution has been proposed to overcome those events.

The frequency assignment problem (FAP) has been extensively studied, and many heuristics were proposed to solve it effectively [4-7]. Since most of these techniques deal with fixed distance and/or frequency constraints they "generate" regular reuse patterns, i.e. solve FAP for networks built following classical cellular concept. However, it does not permit to fulfill design that is adapted to not homogeneous and not isotropic radio wave propagation, as well as to not constant or a priori not known traffic density (distribution of channel requests). The latter point is the most significant factor in the complexity of the efficient network design [8], which must answer the following requirements: it must be capable to find the optimal location of base stations according to the spatial users distribution; it must be capable to find the optimal location of base stations according to the spatial users distribution, it must take into account the propagation conditions to guarantee maximum service coverage, and at last, it must create configurations as homogeneous as possible in order to reduce the complexity of FAP solution.

A number of studies aimed to optimize the network design is known, however, most of them were focused in providing coverage requirements, without paying much attention to the FAP complexity [9-11]. The adaptive traffic design approach leads to a not regular network structure without fixed reuse pattern and requires a signal-to interference (SIR) test after the FAP is solved. What is not less important, overestimation of constraints may waste spectrum.

It would be desirable to find such a technique for the FAP that performs the SIR tests in the assignment process itself, minimizes spectrum and provides the desirable high homogeneity of the network.

2. Vector Quantization

Our problem has certain analogy to a well-known problem in information theory, namely, so called vector quantization (VQ) [12], that involves classification of data blocks into a discrete number of cells in such a way that optimizes some quality criterion, for example mea square distortion. It represents an evident extension of scalar quantization, which includes two operations over continuous-time and continues-amplitude signal: sampling and quantization. This converts the signal into a sequence of discrete-time quantized values. VQ is characterized by its dimension, i.e. by the number of joint samples, which is considered as a single vector. Then, VQ approximates an infinite set of source vectors by a limited set of code vectors (in the scalar case by a limited set of discrete amplitudes), that forms a code book. The evident distortion, which takes place in such representation of a multidimensional signal is measured by a cost function, commonly the squared Euclidean norm or mean square error. In the framework of mobile network design, the source (signal) is the two dimensional field with spatially distributed channel requirements.

The VQ problem is formulated as following: given the source vector $\mathbf{x}$ with probability multidimensional density $f(\mathbf{x})$, the code vector $\mathbf{y}_i$ and the mean square error

$$d^2(\mathbf{x}, \mathbf{y}) = \sum_{j=1}^{k} \left| x_j - y_{ij} \right|^2, \quad i \in \{1,..., N\} \qquad (1)$$

The aim is to find optimal code vector which minimizes

$$D^2 = E_{\mathbf{y}_i}\left[d^2(\mathbf{x}, \mathbf{y}_i) \right], \quad \forall \mathbf{x} \qquad (2)$$

The code book is then partitioned in such a way that for each vector $\mathbf{x}$ a nearest neighbor code vector $\mathbf{y}_i$ exists. This operation is known as a Voronoi partition, with the code vectors being the centroids of each Voronoi region.

In our case we may write out the VQ problem is formulated in such a way:

given a set $\mathbf{S}$ of n points in R^2; to find its Voronoi partition, i.e. to break down if R^2 into n two-dimensional regions $vo(\mathbf{p})$ where $\mathbf{p} \in \mathbf{S}$, which are called the Voronoi cells of $\mathbf{p}$, and are defined as the set of points in R^2 that are closer to any other points in $\mathbf{S}$, or more precisely:

$$vo(\mathbf{p}) = \left\{ \mathbf{x} \in R^2 \,\middle|\, dist(\mathbf{x},\mathbf{p}) \le dist(\mathbf{x},\mathbf{q}) \qquad \forall \mathbf{q} \in (S - \mathbf{p}) \right\} \qquad (3)$$

The *dist* in (3) is the Euclidean distance function. The set of all such cells forms a cell complex with so called Voronoi vertices.

3. Vector quantizer design problem with help of training sequence

In general, the probability density function of the source is rarely known and what's more it is not stationary. The rate distortion theory offers for overcoming this difficulty to use a training sequence that best represents the source in order to optimize the code book by applying a clustering Lloyd algorithm [13]. However, in solution of adaptive VQ it needs certain modifications. If in the clustering analysis one wishes to group things, and the groups can change in time, in VQ one wishes to fix the group in order to get a time-invariant quantizer and then use it on future data outside the training sequence.

The problem of design adaptive vector quantizer design can be stated as follows:

given a vector source with certain statistical parameters, given a distortion measure, given a training sequence consisting of M two-dimensional source vectors

$$\mathbf{X} = \{\mathbf{x}_1, \mathbf{x}_2, ..., \mathbf{x}_M\} \qquad (4)$$

Find a code book and a partition which result together in the smallest average distortion. We assume that the training sequence is sufficiently long, so that all the statistical properties of the source are captured by the training sequence.

Let N be the number of code vectors forming the code book:

$$\mathbf{C} = \{\mathbf{y}_1, \mathbf{y}_2, ..., \mathbf{y}_N\} \qquad (5)$$

Let S_n be the encoding rejoin associated with code vector

$\mathbf{y}_n$ and let us denote the partition of the space as

$$\mathbf{S} = \{S_1, S_2, ..., S_N\} \qquad (6)$$

If the source vector $\mathbf{x}_m$ is in the encoding rejoin S_n, then its approximation, denoted by $\mathbf{q}(\mathbf{x}_m)$ is $\mathbf{y}_n$, i.e.

$$\mathbf{q}(\mathbf{x}) = \mathbf{y}_n \qquad \forall \mathbf{x} \in S_n \qquad (7)$$

Averaging a square distance measure, we obtain:

$$\overline{D} = \frac{\sum_{m=1}^{M} \left\| \mathbf{x}_m - \mathbf{q}(\mathbf{x}_m) \right\|^2}{M} \qquad (8)$$

In nomenclature of optimization theory, our problem can be stated as follows: given $\mathbf{X}$ and N, find $\mathbf{C}$ and $\mathbf{S}$, such that $\overline{D}$ is minimized. If $\mathbf{C}$ and $\mathbf{S}$ represent together a solution, then they must satisfy two criteria of optimality: *nearest neighbor condition* and *centroid condition*. The first criterion requires the following: the encoding region S_n should consist of all vectors that are closer to $\mathbf{y}_n$ than any of the other code vectors, i.e.

$$S_n = \left\{ \mathbf{x} : \left\| \mathbf{x} - \mathbf{y}_n \right\|^2 \le \left\| \mathbf{x} - \mathbf{y}_l \right\|^2 \qquad \forall l \ne n \right\} \qquad (9)$$

This expression is practically the same as (3), meaning that the optimal partition is a Voronoi partition.

The second criterion requires from the code vectors to be average of all training vectors that are in the encoding region.

A solution fulfilling to these two conditions of optimal VQ for a known probabilistic model or on a long training sequence of data may be obtained with help of the Linde–Buzo–Gray (LBG) algorithm [14], with the most known application in speech processing.

3. VQ as a mobile network design strategy

It is almost evident that the VQ problem has some points in common with the problem of effective mobile network design, so it is worth to start by redefining all variables of VQ in the frame work of network design.

A two-dimensional source with known long-term statistical behavior properties is a map with the spatially distributed traffic. Traditionally, this information is represented by the data from so-called service test points (STP), which are defined on a grid with available propagation and service information. However, if in the case of speech processing those STPs may be used themselves as a training sequence in the LBG algorithm, in the network design problem samples of the real space traffic distribution obtained with help of so-called *demand mode concept* (DMC) are preferable [15]. In this approach, a demand node represents the center of the area that contains a quantum of traffic, i.e. a fixed number of call requests per time unit, so the DMC discretizes the traffic distribution in both space and demand. This empirical data for every area of the map is derived from population distribution and is to be stored in a traffic matrix. The demand nodes are dense in highly populated areas and sparse in less populated regions. An alternative approach to create training sequences with the advantage of mathematical tractability is to model the spatial traffic distribution with an analytical bi-variate probability density function and perform a Monte-Carlo process that could create a sampled version of the analytical expression.

The code book of two-dimensional VQ is directly mapped to the set of the network base stations. Finding the optimal code book is equivalent to finding their optimal location. A problem arises when we are going to design a completely new network with predetermined number of base stations. In those cases, the classical cellular concept approach may be applied to generate their optimized set. A network with a regular hexagonal lattice now can be regarded as the equivalent of a uniform quantizer and the corresponding set of base stations as the equivalent of the initial code book to be optimized.

The Euclidean distance as the criteria of optimization is adequate to the case of macro cellular environment where the path loss mainly depends on the distance between transmitter and receiver, increasing according to an exponential rule. It is worth to clarify here that this distortion measure represents a distance excess and therefore an increase of transmitting power and interference to neighbor cells. Hence, minimizing the Euclidean distance means minimization of path loss excess and so optimization of transmitting power.

According to equation (3) the Voronoi partition guaranties that for any demand of service generated within the covered area, the

closest base station will carry it. Under the assumption of propagation conditions defined as a function of only distance, the coverage of the furthest point from a base station within the Voronoi region would guarantee coverage of all the rest. Since the goal of VQ is to achieve a local uniformity of the source probability within every encoding region, the same local uniformity is expected in the network synthesized. This means that in every cell the probability of finding the training sequence of LBG algorithm is slightly the same, which is clear from consideration the fact that in a Voronoi cell complex a higher concentration of training vectors is found in smaller cells.

4. Conclusion

We consider an approach to effective deign of mobile network with not uniform space distribution of requests. It is based on the idea of vector quantization and fulfills all the requirements identified as necessary for adaptation to traffic, i.e. guarantees the optimal location of base stations as well as maximum coverage. The proposed method crates configurations as homogeneous as possible in order to reduce the complexity of the frequency-assignment. Such homogeneity can be achieved by adapting the size of every cell to the user distribution in such a way that the approximately the same number of users can be expected within every cell, leading to the same number of channel requests.

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Digital Design and Fabrication: A Review of Trend and Its Impact in the African Context

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***Abstract*—** In recent years, the architecture, engineering, and construction (A.E.C.) industry have been exposed to important innovations, most notably the global integration of digital design and fabrication (D.D.F.) processes in the industry's workflow. Despite this evolution in that sector, Africa was excluded from the examination of this development. The reason behind this exclusion is the preconceived view of it as a developing region that still employs traditional methods of construction. The primary objective of this review is to investigate the trend of digital construction (D.C.) in the African environment and the difficulties in its regular utilization of it. This objective can be attained by recognizing the notion of distributed computing in Africa and evaluating the impact of the projects deploying this technology on both the immediate and broader contexts. The paper's methodology begins with the collection of data from 224 initiatives throughout Africa. Then, 50 of these projects were selected based on the criteria of the project's recency, typology variety, and location diversity. After that, a literature-based comparative analysis was undertaken. This study's findings reveal a pattern of motivation for applying digital fabrication processes. Moreover, it is essential to evaluate the socio-economic effects of these projects on the population living near the analyzed subject. The last step in this study is identifying the influence on the neighboring nations.

***Keywords*—** Africa, digital construction, digital design, fabrication.

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Hyers -Ulam Stability of Nonstandard Volterraintegral Equations on Unbounded Time Scales

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Abstract

In this paper, we study Hyers–Ulam stability of nonstandard Volterra integral equations on unbounded time scales. We give the existence and uniqueness conditions of the solutions of nonstandard Volterra-type integral equations on time scales using the Banach contraction principle, Bielecki-type norm, and Lipschitz-type functions. Furthermore, it allows getting sufficient conditions for Hyers-Ulam stability.

keywords: Volterra integral equation, Hyers-Ulam stability, time scales.

1 Introduction

In 1940 S.M. Ulam [24] at the Mathematics Club of the University of Wisconsin raised the question of when a solution of an equation, differing slightly from a given one, must be somehow near to the exact solution of the given equation. In the following year, D.H. Hyers [11] gave an affirmative answer to the question of S.M. Ulam for the Cauchy additive functional equation in a Banach space. So the stability concept proposed by S.M. Ulam and D.H. Hyers was named as *Hyers-Ulam stability*. Afterward, Th.M. Rassias [17] introduced new ideas of Hyers-Ulam stability using unbounded right-hand side in the involved inequalities, depending on certain functions, introducing, therefore, the so-called *Hyers-Ulam-Rassias stability*. However, we will use only the term Hyers-Ulam stability in this article.

In 2007, S.M. Jung [14] proved, using a fixed point approach, that the Volterra nonlinear integral equation is Hyers-Ulam-Russias stable, on a compact interval under certain conditions. Then several authors [5, 12, 13] generalized the previous result on the Volterra integral equations to an infinite interval in

the case when the integrand is Lipschitz with a fixed Lipschitz constant. In the near past, many research papers have been published about Ulam-Hyers stability of Volterra integral equations of different types including nonlinear Volterra integro-differential equations, mixed integral dynamic system with impulses, etc. [6, 7, 20, 21, 22, 25].

The theory of time scales analysis has been rising fast and has acknowledged a lot of interest. The pioneer of this theory was S. Hilger [9]. He introduced this theory in 1988 with the inspiration to unify continuous and discrete calculus. For the introduction to calculus on time scales and to the theory of dynamic equations on time scales, we recommend the books [3] and [4] by M. Bohner and A. Peterson.

T. Kulik and C.C. Tisdell [15, 23] gave the basic qualitative and quantitative results to Volterra integral equations on time scales in the case when the integrand is Lipschitz with a fixed Lipschitz constant. A. Reinfelds and S. Christian [18, 19] generalized previous results using the Lipschitz type function, which can be unbounded.

To the best of our knowledge, the first ones who pay attention to Hyers-Ulam stability for Volterra integral equations on time scales are S. Andras, A.R. Meszaros [1] and L. Hua, Y. Li, J. Feng [10]. However, they restricted their research to the case when integrand satisfies Lipschitz conditions with some Lipschitz constant. We generalize the results of [1, 10] using the Lipschitz type function, which can be unbounded, and Banach's fixed point theorem at appropriate functional space with Bielecki type norm.

D.B. Pachpatte [16] studied qualitative properties of solutions of general nonlinear Volterra integral equation

$$x(t) = f\left(t, x(t), \int_a^t K(t, s, x(s))\right) \Delta s$$

on time scales. In the present paper, using the methods developed at [18, 19], we give new existence and uniqueness conditions of solutions and analyze Hyers-Ulam stability for the following class of Volterra type integral equation on an arbitrary time scales $\mathbf{T}$

$$x(t) = f\left(t, x(t), x(\sigma(t)), \int_a^t K(t, s, x(s), x(\sigma(s)))\, \Delta s\right),\ a, t \in I_{\mathbf{T}} = [a, +\infty) \cap \mathbf{T}. \tag{1}$$

This type of integral equation could be very useful for modeling economic processes, for example, a Keynesian-Cross model with "lagged" income [8, 23].

2 Preliminaries on time scales

In this section, we present some basic notation, definitions, and properties concerning the calculus on time scales, for more details the reader is referred to [3, 4]. A *time scale* $\mathbf{T}$ is an arbitrary nonempty closed subset of real numbers $\mathbf{R}$. Since time scales may or may not be connected, we need the concept of

jump operators. For $t \in \mathbf{T}$, the *forward jump operator* $\sigma\colon \mathbf{T} \to \mathbf{T}$ is defined by $\sigma(t) = \inf\{s \in \mathbf{T}\colon s > t\}$, while the *backward jump operator* $\rho\colon \mathbf{T} \to \mathbf{T}$ is defined by $\rho(t) = \sup\{s \in \mathbf{T}\colon s < t\}$. In this definitions we put $\inf \emptyset = \sup \mathbf{T}$ and $\sup \emptyset = \inf \mathbf{T}$, where $\emptyset$ denotes the empty set. Using these operators we can classify the points of time scale $\mathbf{T}$ as *left dense*, *left scattered*, *right dense* and *right scattered* according to whether $\rho(t) = t$, $\rho(t) < t$, $\sigma(t) = t$ and $\sigma(t) > t$ respectively. If $\mathbf{T}$ has a left scattered maximum m, then $\mathbf{T}^{\kappa} = \mathbf{T} \setminus \{m\}$, otherwise set $\mathbf{T}^{\kappa} = \mathbf{T}$. The function $g\colon \mathbf{T} \to \mathbf{R}$ is called *rd-continuous* provided it is continuous at every right dense point in $\mathbf{T}$ and its left-sided limits exist (finite) at every left dense point in $\mathbf{T}$. The *graininess function* $\mu\colon \mathbf{T} \to [0, +\infty)$ is defined by $\mu(t) = \sigma(t) - t$. The function $g\colon \mathbf{T} \to \mathbf{R}$ is *regressive* if

$$1 + \mu(t)g(t) \neq 0 \quad \text{for all} \quad t \in \mathbf{T}^{\kappa}.$$

Assume $g\colon \mathbf{T} \to \mathbf{R}$ is a function and fix $t \in \mathbf{T}^{\kappa}$. The *delta derivative* (also Hilger derivative) $g^{\Delta}(t)$ exists if for every $\varepsilon > 0$ there exists a neighbourhood $U = (t - \delta, t + \delta) \bigcap \mathbf{T}$ for some $\delta > 0$ such that

$$\left|(g(\sigma(t)) - g(s)) - g^{\Delta}(t)(\sigma(t) - s)\right| \leq \varepsilon \left|\sigma(t) - s\right|, \text{ for all } s \in U.$$

If g is rd-continuous, than there is function F [3, 4] such that $F^{\Delta}(t) = g(t)$. In this case, we define the (Cauchy) delta integral by

$$\int_r^s g(t)\,\Delta t = F(s) - F(r), \text{ for all } r, s \in \mathbf{T}.$$

Let $\beta\colon \mathbf{T} \to \mathbf{R}$ be a non-negative (and therefore regressive) and rd-continuous scalar function. The Cauchy initial value problem for scalar linear equation

$$x^{\Delta} = \beta(t)x, \quad x(a) = 1, \quad a \in \mathbf{T}$$

has the unique solution $e_{\beta}(\cdot, a)\colon \mathbf{T} \to \mathbf{R}$ [3, 4]. More explicitly, using the cylinder transformation the *exponential function* $e_{\beta}(\cdot, a)$ is given by

$$e_{\beta}(t, a) = \exp\left(\int_a^t \xi_{\mu(s)}(\beta(s))\,\Delta s\right),$$

where

$$\xi_h(z) = \begin{cases} z, & h = 0; \\ \frac{1}{h}\log(1 + hz), & h > 0. \end{cases}$$

We will use the following property of exponential function [3, 4]

$$e_{\beta}(\sigma(t), a) = (1 + \mu(t)\beta(t))e_{\beta}(t, a).$$

Observe that we also have Bernoulli's type estimate

$$1 + \int_a^t \beta(s)\,\Delta s \leq e_{\beta}(t, a) \leq \exp\left(\int_a^t \beta(s)\,\Delta s\right)$$

for all $t \in I_{\mathbf{T}} = [a, +\infty) \cap \mathbf{T}$.

Let $|\cdot|$ denote the Euclidean norm on $\mathbf{R}^n$. We will consider the linear space of continuous functions $C(I_{\mathbf{T}}; \mathbf{R}^n)$ such that,

$$\sup_{t \in I_{\mathbf{T}}} \frac{|x(t)|}{e_\beta(t, a)} < \infty$$

and denote this special space by $C_\beta(I_{\mathbf{T}}; \mathbf{R}^n)$. The space $C_\beta(I_{\mathbf{T}}; \mathbf{R}^n)$ endowed with Bielecki type norm

$$\|x\|_\beta = \sup_{t \in I_{\mathbf{T}}} \frac{|x(t)|}{e_\beta(t, a)}$$

is a Banach space.

3 Hyers-Ulam stability of nonstandard Volterra integral equation on unbounded time scales

Let us introduce new existence and uniqueness conditions of solutions and analyze Hyers-Ulam stability for the following class of nonstandard Volterra type integral equation 1. We assume that Lipschitz-type functions L_1 and L_2 can be unbounded rd-continuous functions. The use of Bielecki-type norms related to Lipschitz-type functions allows choosing a suitable functional space to prove the following theorem.

Theorem 1 *Consider the integral equation 1. Let* $K\colon I_{\mathbf{T}} \times I_{\mathbf{T}} \times \mathbf{R}^n \times \mathbf{R}^n \to \mathbf{R}^n$ *be continuous in its first, third, and fourth variables and rd-continuous in its second variable,* $f\colon I_{\mathbf{T}} \times \mathbf{R}^n \times \mathbf{R}^n \times \mathbf{R}^n \to \mathbf{R}^n$ *be continuous,* $L_1, L_2\colon I_{\mathbf{T}} \to \mathbf{R}$ *be rd-continuous,* $\sup_{s \in I_{\mathbf{T}}} |L_1(s)\mu(s)| = q < \infty$, $\sup_{s \in I_{\mathbf{T}}} |L_2(s)\mu(s)| = r < 1$, $1 < \gamma < r^{-1}$ *and* $\beta(s) = \frac{[L_1(s)+L_2(s)]\gamma}{1-r\gamma}$. *If*

$$|f(t, x, x', x") - f(t, \bar{x}, \bar{x}', \bar{x}")| \le M(|x - \bar{x}| + |x' - \bar{x}'| + |x" - \bar{x}"|),$$

where

$$M\left(1 + \frac{1 + p\gamma}{1 - r\gamma} + \frac{1}{\gamma}\right) < 1,$$

$$|K(t, s, x, \bar{x}) - K(t, s, x', \bar{x}')| \le L_1(s)|x - x'| + L_2(s)|\bar{x} - \bar{x}'|,\ s < t,$$

and

$$m = \sup_{t \in I_{\mathbf{T}}} \frac{1}{e_\beta(t, a)} \left| f\left(t, 0, 0, \int_a^t K(t, s, 0, 0)\, \Delta s\right)\right| < \infty,$$

then the integral equation 1 has a unique solution $x \in C_\beta(I_{\mathbf{T}}; \mathbf{R}^n)$.

Proof 1 *Let* $L_1, L_2\colon I_{\mathbf{T}} \to \mathbf{R}$ *be the Lipschitz functions and let* $\beta(s) = \frac{[L_1(s)+L_2(s)]\gamma}{1-\gamma r}$, *where* $1 < \gamma < r^{-1}$. *It follows*

$$1 + \mu(s)\beta(s) = 1 + \frac{\mu(s)(L_1(s) + L_2(s))\gamma}{1 - \gamma r} = 1 + \frac{(q + r)\gamma}{1 - \gamma r} = \frac{1 + q\gamma}{1 - r\gamma}$$

and

$$\begin{aligned} L_1(s)+L_2(s)(1+\mu(s)\beta(s)) &= L_1(s)+L_2(s)+L_2(s)\mu(s)\beta(s) \\ &\le L_1(s)+L_2(s)+\frac{r\left[L_1(s)+L_2(s)\right]\gamma}{1-r\gamma} \\ &= \frac{L_1(s)+L_2(s)}{1-r\gamma}=\frac{\beta(s)}{\gamma}. \end{aligned}$$

Consider the Banach space $C_\beta(I_{\mathbf{T}};\mathbf{R}^n)$. *To prove the Theorem 1, we define an operator* $F\colon C_\beta(I_{\mathbf{T}};\mathbf{R}^n)\to C_\beta(I_{\mathbf{T}};\mathbf{R}^n)$ *by expression*

$$[Fx](t)=f\left(t,x(t),x(\sigma(t)),\int_a^t K(t,s,x(s),x(\sigma(s)))\,\Delta s\right).$$

We show that for any $u,v\in C_\beta(I_{\mathbf{T}};\mathbf{R}^n)$

$$\begin{aligned} \|Fu-Fv\|_\beta &= \sup_{t\in I_{\mathbf{T}}}\frac{|[Fu](t)-[Fv](t)|}{e_\beta(t,a)} \\ &= \sup_{t\in I_{\mathbf{T}}}\frac{1}{e_\beta(t,a)}\left|f\left(t,u(t),u(\sigma(t)),\int_a^t K(t,s,u(s),u(\sigma(s)))\,\Delta s\right)\right. \\ &- \left. f\left(t,v(t),v(\sigma(t)),\int_a^t K(t,s,v(s),v(\sigma(s)))\,\Delta s\right)\right| \\ &\le M\sup_{t\in I_{\mathbf{T}}}\frac{1}{e_\beta(t,a)}\left(|u(t)-v(t)|+|u(\sigma(t))-v(\sigma(t))|\right. \\ &+ \left.\left|\int_a^t K(t,s,u(s),u(\sigma(s)))\,\Delta s-\int_a^t K(t,s,v(s),v(\sigma(s)))\,\Delta s\right|\right) \\ &= I_1+I_2+I_3. \end{aligned}$$

We get

$$I_1=M\sup_{t\in I_{\mathbf{T}}}\frac{1}{e_\beta(t,a)}|u(t)-v(t)|=M\|u-v\|_\beta$$

$$I_2=M\sup_{t\in I_{\mathbf{T}}}\frac{1+\mu(t)\beta(t)}{e_\beta(\sigma(t),a)}|u(\sigma(t))-v(\sigma(t))|=M\frac{1+q\gamma}{1-r\gamma}\|u-v\|_\beta$$

$$\begin{aligned} I_3 &= M\sup_{t\in I_{\mathbf{T}}}\frac{1}{e_\beta(t,a)}\left|\int_a^t K(t,s,u(s),u(\sigma(s)))\,\Delta s-\int_a^t K(t,s,v(s),v(\sigma(s)))\,\Delta s\right| \\ &\le M\sup_{t\in I_{\mathbf{T}}}\frac{1}{e_\beta(t,a)}\left|\int_a^t\left[L_1(s)|u(s)-v(s)|+L_2(s)|u(\beta(s))-v(\beta(s))|\right]\Delta s\right| \\ &\le M\|u-v\|_\beta\sup_{t\in I_{\mathbf{T}}}\frac{1}{e_\beta(t,a)}\int_a^t\left[L_1(s)+L_2(s)(1+\mu(s)\beta(s))\right]e_\beta(s,a)\,\Delta s] \\ &\le \frac{M}{\gamma}\|u-v\|_\beta\sup_{t\in I_{\mathbf{T}}}\frac{1}{e_\beta(t,a)}\int_a^t\beta(s)e_\beta(s,a)\,\Delta s \end{aligned}$$

$$
\begin{aligned}
&= \frac{M}{\gamma}\|u-v\|_\beta \sup_{t\in I_{\mathbf{T}}} \frac{1}{e_\beta(t,a)} \int_a^t e_\beta^{\Delta}(s,a)\,\Delta s \\
&= \frac{M}{\gamma}\|u-v\|_\beta \sup_{x\in I_{\mathbf{T}}} \frac{1}{e_\beta(t,a)} (e_\beta(t,a)-1) \\
&= \frac{M}{\gamma}\|u-v\|_\beta \sup_{t\in I_{\mathbf{T}}} \left(1-\frac{1}{e_\beta(t,a)}\right) = \frac{M}{\gamma}\|u-v\|_\beta.
\end{aligned}
$$

It follows

$$\|Fu-Fv\|_\beta \le M\|u-v\|_\beta \left(1+\frac{1+q\gamma}{1-r\gamma}+\frac{1}{\gamma}\right).$$

We show that $F\colon C_\beta(I_{\mathbf{T}};\mathbf{R}^n) \to C_\beta(I_{\mathbf{T}};\mathbf{R}^n)$. *Let* $x \in C_\beta(I_{\mathbf{T}};\mathbf{R}^n)$. *Taking norms, we obtain*

$$
\begin{aligned}
\|Fx\|_\beta = \|Fx - F0 + F0\|_\beta &\le \|Fx-F0\|_\beta + \|F0\|_\beta \\
&\le M\|x\|_\beta \left(1+\frac{1+q\gamma}{1-r\gamma}+\frac{1}{\gamma}\right) + m.
\end{aligned}
$$

As $M\left(1+\frac{1+q\gamma}{1-r\gamma}+\frac{1}{\gamma}\right) < 1$, *we see that* F *is a contraction map and so Banach's fixed point theorem applies, yielding the existence of a unique fixed point* x *of the map* F.

Definition 1 *We say that integral equation 1 is Hyers-Ulam stable if there exists a constant* $C > 0$ *such that for each real number* $\varepsilon > 0$ *and for each solution* $x \in C_\beta(I_{\mathbf{T}};\mathbf{R}^n)$ *of the inequality*

$$\sup_{t\in I_{\mathbf{T}}} \frac{\left|x(t) - f\left(t, x(t), x(\sigma(t)), \int_a^t K(t,s,x(s),x(\sigma(s)))\,\Delta s\right)\right|}{e_\beta(t,a)} = \|x-Fx\|_\beta \le \varepsilon$$

there exists a solution $x_0 \in C_\beta(I_{\mathbf{T}};\mathbf{R}^n)$ *of the integral equation 1 with the property*

$$\|x-x_0\|_\beta \le C\varepsilon.$$

Let us find a sufficient condition for the nonstandard Volterra type integral equation 1 to be Hyers-Ulam stable.

Theorem 2 *If* $x_0 \in C_\beta(I_{\mathbf{T}};\mathbf{R}^n)$ *is solution of nonstandard Volterra type integral equation 1 and*

$$M\left(1+\frac{1+q\gamma}{1-r\gamma}+\frac{1}{\gamma}\right) < 1,$$

then nonstandard Volterra type integral equation 1 is Hyers-Ulam stable.

Proof 2 *According to Theorem 1, there is a unique solution* $x_0 \in C_\beta(I_{\mathbf{T}};\mathbf{R}^n)$ *to the nonstandard Volterra type integral equation 1 in Banach space. Therefore we get the estimate*

$$\|x-x_0\|_\beta \le \|x-Fx\|_\beta + \|Fx-Fx_0\|_\beta$$

$$\leq \varepsilon + M\left(1 + \frac{1+q\gamma}{1-r\gamma} + \frac{1}{\gamma}\right)\|x - x_0\|_\beta.$$

Hence,

$$\|x - x_0\|_\beta \leq C\varepsilon,$$

where $C = \left(1 - M\left(1 + \frac{1+q\gamma}{1-r\gamma} + \frac{1}{\gamma}\right)\right)^{-1}$.

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Extended Agegraphic Dark Energy with GUP

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***Abstract*—** Dark Energy origin is unknown and so describing this mysterious component in large scale structure needs to manipulate our theories in general relativity. Although in most models, dark energy arises from extra terms through modifying Einstein-Hilbert action, maybe its origin traces back to fundamental aspects of ground energy of space-time given in quantum mechanics. Hence, diluting space-time in general relativity with quantum mechanics properties leads to the Karolyhazy relation corresponding energy density of quantum fluctuations of space-time. Through generalized uncertainty principle and an eye to Karolyhazy approach in this study we extend energy density of quantum fluctuations of space-time. Also, the application of this idea is considered in late time evolution and we have shown how extra term in generalized uncertainty principle plays as a plausible interaction term role in suggested model.

***Keywords*—** Generalized Uncertainty Principle; Karolyhazy Approach; Agegraphic Dark Energy.

The observations confirm the Universe expands with acceleration phase [1]. Due to gravitation effects of radiation and matter, this expansion is unlikely governs with radiation-matter fields. Hence, we need another unknown field to explain the evolution of the Universe in large structure which called "dark energy". Such fluid characterized with negative pressure, $\omega < 0$ [2].

There are different models and approaches are applied to explain dark energy. Maybe the cosmological constant scenario is simplest form of dark energy in which pressure and density of such field are constant with time [2]. Although, this model satisfies observations, it suffers from two cosmic (coincidence) and theoretical (fine tuning) problems [3]. Consequently, the other approaches are considered. Modifying Einstein-Hilbert action is one of the robust ways in this context. These modifications in general built in geometry part of action wherein Ricci scalar replaced with different plausible scalars built from Riemann tensor and its derivatives. Among these alternative models the $f(R)$ [4] gravity has attracted more attention rather than other scenarios. However, recently it has been shown dark energy may come from full non-Einsteinian matter distributions through adding squared energy-momentum term to gravity action [5].

In the absence of full quantum version of general relativity studying dark energy as ground energy state faces with different challenges, theoretically [2]. However, applying some aspects of quantum mechanics in relativity theory is worthwhile to explore space-time properties in quantum levels. In this context, dark energy field comes from high energy physics. The two models, holographic and Agegraphic dark energy are two successful dark energy scenarios built by constraining relativity theory with some quantum properties. First one comes from holographic principle [6], and this fact that entropy of black hole given by its surface [7]. Following this principle and considering cosmological constant parameter, may energy density of dark energy be proportional to Hubble parameter, $\rho_X \sim H^2$ [8]. However, such dark energy gives no accelerated expansion in late time and thus it does not satisfy observations [9]. In another suggested case, Susskind and his colleagues have attempted to illustrate dark energy density with the particle horizon size [10]. The equation of state of this model is greater than $-1/3$ and thus it gives no valuable scenario for current Universe. Following these pioneer studies, may energy density of dark energy is proportional to Ricci scalar of homogenous and isotropic Universe given by FLRW metric [11]. Although this model called Ricci holographic dark energy is well-fixed with current observations, it has some errors to explain age of old celestial objects. However, as shown in [12], viscous Ricci holographic dark energy alleviated this problem. In other attempt, recently we have reconsidered holographic dark energy in which energy density given by acceleration of particle horizon evolution per its length [13]. This model gives more flexible dark energy with introducing set of two constants and thus as discussed it alleviates some inconsistencies in Ricci holographic dark energy.

In other hand, Karolyhazy and his colleagues with an eye to uncertainty principle have shown that the distance cosmic time in Minkowski space-time cannot be known to better accuracy than $\delta t = \lambda t_P^{2/3} t^{1/3}$ wherein λ denotes arbitrary dimensio-nless parameter when t_P is the reduced Planck time [14]. With aid of this relation, Maziashvili proposed the energy density of metric fluctuation of the Minkowski geometry $\rho \sim t_P^{-2} t^{-2}$ [15]. This energy density can be considered as energy density of dark energy and so quantum fluctuation has been introduced as origin of dark energy. In original agegraphic scenario, parameter time t is considered as age of the Universe [16]. Although, this model illustrates

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no accelerated evolution for late-time Universe and suffers from some difficulty to describe the matter-dominated era, it onsets trigger of more studies around this model of dark energy. As shown in [17], considering t as conformal time gives dark energy with correct equation of state $\omega_X < -1/3$ and thus the Universe expands with acceleration. The interaction models for conformal agegraphic also are studied [18].

As discussed, while holographic dark energy arises from entropy of black holes, the agegraphic dark energy appears from constraints of uncertainty principle on the space-time. As result, extending uncertainty principle leads us to generalized and new forms of agegrpahic dark energy. One of the new forms proposed due to extending uncertainty relation between time and energy [19]. In this study, we return to Karolyhazy approach and try to explore quantum fluctuation of space-time while uncertainty principle given by: (Throughout this paper, we adopt the Planck units, i. e. $c = \hbar = G = 1$ while reducing Planck mass $m_P^2 = (8\pi)^{-1}$ and reduced Planck length and time are given by l_p and t_p, respectively)

$$\delta x \delta p = \frac{1}{2}(1 + \alpha \delta x^2) \tag{1}$$

where α is constant of model. As we will show, this relation gives no equal agegraphic dark energy studied [19] and also solves the original agegraphic problem in describing accelerated expansion in current Universe.

In the follows of Karolyhazy approach, let we have so light clock in our hand consisting of a spherical mirror inside which light is bouncing. Such clock has the rest mass m and the radius r_c. The position-momentum uncertainty relation (1) implies that the clock is characterized by the momentum uncertainty

$$\delta p = \frac{1}{4r_c}(1 + 4\alpha r_c^2) \tag{2}$$

where $\delta x = 2r_c$. Furthermore, its energy takes the form, namely:

$$mass\ of\ clock \approx m + \frac{\delta p^2}{2m} \tag{3}$$

As the size of the clock determines its resolution time presenting, the error during the time measurement in flatness space-time (Minkowskian geometry) has the following form

$$\delta t = 2r_c + \frac{t t_p^2}{r_c}\left(m + \frac{\delta p^2}{2m}\right) \tag{4}$$

Substituting relation (2) when we assume $|\alpha| \ll 1$ yields the errors in time such as

$$\delta t \approx 2r_c + \frac{t t_p^2}{r_c}\left(m + \frac{1}{32 m r_c^2} + \frac{\alpha}{4m}\right) \tag{5}$$

Minimizing this expression with respect to m and r_c, we have

$$\delta t = \alpha\sqrt{2} t t_p^2 + \frac{3\sqrt{2}}{2} t^{1/3} t_p^{2/3} \tag{6}$$

Obviously, ignoring first term reproduces the original relation derived by Karolyhazy [14].

In order to study fluctuations in Minkowski space-time and calculating corresponded energy density, Maziashvili argued due to uncertainty on time, the fluctuations in time array of an arbitrary metric given by [15]

$$\int_{t_p}^{t} \sqrt{1 + \delta g_{00}(\xi)}\, d\xi = t - t_p + \delta t \tag{7}$$

Differentiating with respect to time t when δt given by Eq. (6), we find

$$\sqrt{1 + \delta g_{00}(t)} = 1 + \frac{1}{\sqrt{2}}\left(\frac{t_p}{t}\right)^{2/3} + \alpha\sqrt{2} t_p^2 \tag{8}$$

As result, the classical energy density given by

$$\rho_{classic} \approx \frac{1}{l_p^2}\left(\frac{d g_{00}(t)}{dt}\right)^2 \approx \frac{1}{t^{10/3} t_p^{2/3}} + \frac{4\alpha}{\sqrt{2}} \frac{t_p^{4/3}}{t^{10/3}} \tag{9}$$

However, the corresponding energy density in quantum mechanics is given by [15]

$$\rho_q \approx \frac{1}{t \delta t^3} \tag{10}$$

Therefore, we have:

$$\rho_q \sim \frac{1}{t^2 t_p^2}\left(1 - 2\alpha t^{2/3} t_p^{4/3}\right) \tag{11}$$

Such energy density can be considered as ground energy of spacetime originates from quantum properties of own spacetime features. Moreover, since this is the energy for the existence of spacetime, its interaction with the matter should be only gravitational. Comparing relation (11) with corresponding parameter in Maziashvili original work [15] shows how extra term in modified uncertainty relation (1) plays key role in evolution of ground energy of spacetime. To show this fact, it is worthwhile to check model and compare it with original agegraphic dark energy scenario proposed with Cai [16].

As the first possible model, one may assume time t in relation (11) presents age of the Universe which proposed with Cai, first:

$$T = \int_0^a \frac{da}{Ha} \tag{12}$$

where H is the Hubble parameter and a denotes the cosmic scale factor. Following this assumption, the relation (11) becomes

$$\rho_q = \frac{3n^2 m_p^2}{T^2}\left(1 - \frac{2\alpha T^{2/3}}{m_p^{4/3}}\right) \tag{13}$$

where $3n^2$ is an arbitrary proportional constant. This energy density of quantum fluctuations can be considered as the dark energy in our Universe. So, in follows of our study we set $\rho_q = \rho_X$.

$$\rho_X = \frac{3n^2 m_p^2}{T^2}\left(1 - 2\tilde{\alpha}T^{2/3}\right) \quad (14)$$

in which we define

$$\tilde{\alpha} = \alpha m_p^{-4/3} \quad (15)$$

Consequently, the Friedmann equation for current Universe becomes

$$H^2 = \frac{n^2}{T^2}\left(1 - 2\tilde{\alpha}T^{2/3}\right) + \frac{\rho_m}{3m_p^2} \quad (16)$$

where ρ_m is the energy density of matter. Defining fractional energy densities

$$\Omega_m = \frac{\rho_m}{3m_p^2 H^2}, \quad \Omega_X = \frac{n^2}{T^2 H^2}\left(1 - 2\tilde{\alpha}T^{2/3}\right). \quad (17)$$

and using the current age of the Universe $T = 13.8$, Hubble constant $H_0 = 72$ and $\Omega_{X0} = 0.73$, we find n as function of $\tilde{\alpha}$, namely:

$$n \approx \frac{3.65}{\sqrt{10.7 - 122\tilde{\alpha}}} \quad (18)$$

This equation illustrates $\tilde{\alpha} < 0.087$. Before exploring Eq. (16) in presence matter field, let us to investigate so late-time Universe wherein dark energy is assumed to be uniqueness celestial component. Under such condition, solving Eq. (16) yields

$$a = (t + \beta)^n e^{-\frac{3n\tilde{\alpha}}{2}(t+\beta)^{2/3}} \quad (19)$$

where β is an integration constant which can determined by using the present scale factor $a = a_0$. Also, Hubble parameter becomes

$$H = \frac{n}{t+\beta} - \frac{n\tilde{\alpha}}{(t+\beta)^{1/3}} \quad (20)$$

which confirms even in absence of matter to have positive Hubble parameter, one should have

$$\tilde{\alpha} < 1/(t + \beta)^{2/3} \quad (21)$$

for each moment of cosmic time and so $\alpha < 0.043$. In the follows of this study, we assume $|\tilde{\alpha}| \ll 1$. As result, the scale factor (19) given, approximately

$$a \approx (t + \beta)^n - \frac{3n\tilde{\alpha}}{2}(t + \beta)^{n+2/3} \quad (22)$$

The equation (22) is not in conflict with corresponding scale factor in Cai work [16].

With aid of Eqs. (14) and (19), the equation of state for dark energy given by

$$\omega_X = -1 - \frac{8\tilde{\alpha}\tau - 6\tau^{1/3}}{9n(2\tilde{\alpha}\tau^{1/3} - 1)(\tilde{\alpha}\tau - \tau^{1/3})} \quad (23)$$

where we define $\tau = t + \beta$. In the absence of $\tilde{\alpha}$, this equation of state is constant and gives original form [16]

$$\omega_X = -1 + \frac{2}{3n} \quad (24)$$

However, for $\tilde{\alpha} \neq 0$ it evolves with time and implies ratio of pressure to density of dark energy vary with time. Till now and in absence of matter, the model shows due to modified entropy expression (1), our agegraphic scenario is more complicated with respect to Cai study.

In the presence of matter field, one may assume extra terms depending on $\tilde{\alpha}$ plays key role in interaction scenario between matter and dark energy. In order to explore this assumption, we study continuity equations of matter and dark energy given by, respectively:

$$\dot{\rho}_m + 3H\rho_m = Q \quad (25)$$

$$\dot{\rho}_X + 3H(1 + \omega_X)\rho_X = -Q \quad (26)$$

where Q is the interaction term. Taking derivative from Eq. (14) with respect to time, one has

$$\dot{\rho}_X = -\frac{2\dot{T}}{T}\rho_X - \frac{4\tilde{\alpha}n^2 m_p^2}{T^2}\left(\frac{\dot{T}}{T}\right)T^{2/3} \quad (27)$$

Substituting Eq. (27) in Eq. (26) yields

$$\left(3H(1 + \omega_X) - \frac{2\dot{T}}{T}\right)\rho_X - \frac{4\tilde{\alpha}n^2 m_p^2}{T^2}\left(\frac{\dot{T}}{T}\right)T^{2/3} = -Q \quad (28)$$

In the absence of mechanism of microscopic origin of interaction between matter and dark energy, we can suggest different interaction form, phenomenologically. In this study, we assume

$$Q = \frac{4\tilde{\alpha}n^2 m_p^2}{T^2}\left(\frac{\dot{T}}{T}\right)T^{2/3} \quad (29)$$

Therefore, the interaction depends on age of the Universe, its time evolution and α. As result, power term in uncertainty relation proposed as origin of interaction between matter and dark energy. Using *e-folding* number $x = \ln(x)$ in differential equation (28) gives

$$-\frac{2T'}{T} + 3(1 + \omega_X) = 0 \quad (30)$$

where prime denotes derivative with respect to x. To simplify our model, we assume that $\omega_X = const.$ Hence, the age of Universe is given by:

$$T = T_0 e^{3(1+\omega_X)x} \quad (31)$$

and or

$$T = T_0 a^{3(1+\omega_X)} \quad (32)$$

Using definition (12), the scale factor becomes

$$a = \left(c_0 + \frac{t}{T_0}\right)^{1/3(1+\omega_X)} \quad (33)$$

where c_0 is the constant of model. Furthermore, from Eq. (33) one finds the scale factor can drive the Universe with accelerated expansion only for $-1 < \omega_X < -2/3$.

To check how the energy density of dark energy evolves with redshift, by using the Friedmann equation (16), we obtain the equation of motion for Ω_X as

$$\Omega_X' + 3\Omega_X(1 + 2\omega_X - \omega_X\Omega_X) + 36\tilde{\alpha}T_0 n^2(1+\omega_X)^3 e^{3(1+\omega_X)x} = 0 \quad (34)$$

This equation can be integrated analytically such as

$$\Omega_X = \left(\frac{c_1(1+\omega_X)\chi Y_x(\Upsilon+1,\Pi_x)}{\omega_X[c_1 Y_x(\Upsilon,\Pi_x)+J_x(\Upsilon,\Pi_x)]} + \frac{(1+\omega_X)\chi J_x(\Upsilon+1,\Pi_x)}{\omega_X[c_1 Y_x(\Upsilon,\Pi_x)+J_x(\Upsilon,\Pi_x)]}\right) e^{3(1+\omega_X)x} \quad (35)$$

where c_1 is constant and J_x and Y_x are first and second kind of Bessel function, respectively while we define constants set

$$\chi = 2i\sqrt{3\tilde{\alpha}n^2\omega_X(1+\omega_X)}T_0^{1/3} \quad (36)$$

$$\Upsilon = \frac{3(1+2\omega_X)}{2(1+\omega_X)} \quad (37)$$

and function

$$\Pi_x = 3\chi e^{(1+\omega_X)x} \quad (38)$$

Constraining the fractional energy density through its current value Ω_{X0}, one has

$$c_{1\pm} = -\frac{i(1+\omega_X)\chi J_x(\Upsilon+1,\pm\Pi_0) - i\omega_X\Omega_{X0}J_x(\Upsilon,\pm\Pi_0)}{i(1+\omega_X)\chi Y_x(\Upsilon+1,\pm\Pi_0) - i\omega_X\Omega_{X0}Y_x(\Upsilon,\pm\Pi_0)} \quad (39)$$

Analyzing evolution of fractional energy density of dark energy shows $c_{1_}$is not valuable constant for our model. Hence in Fig. 1, by using c_{1_+} the fractional energy density Ω_X with respect to redshift is plotted. As shown, the model is not in conflict with ΛCDM model wherein in redshift $z \approx -1$, dark energy governs our Universe.

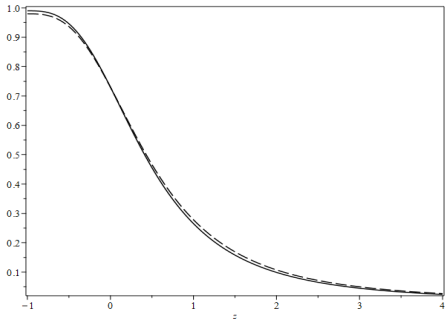

FIG. 1: The evolution of dark energy versus redshift z for $\omega_X = -0.99$ (solid curve) and -0.98 (dash curve) when $\Omega_{X0} = 0.73$, $T_0 = 13.8$ Gyr and $\tilde{\alpha} = -0.01$.

With straightforward computation, the deceleration parameter reads,

$$q = \frac{1}{2}(1 + 3\omega_X\Omega_X) \quad (40)$$

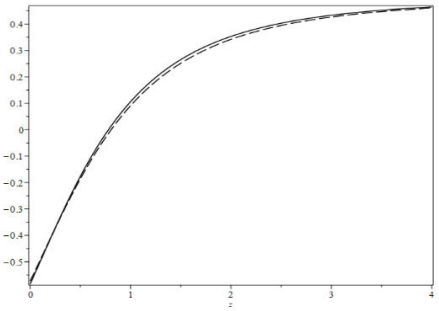

FIG. 2: Deceleration parameter of our model as function of redshift for $\omega_X = -0.99$ (solid curve) and -0.98 (dash curve) when we set $\Omega_{X0} = 0.73$ and $T_0 = 13.8$ Gyr and $\tilde{\alpha} = -0.01$.

In Fig. 2, the deceleration parameter for our model is plotted. As illustrated, our scenario in which the extra term in continuity equation (28) plays the interaction role between dark energy and matter satisfies observations. It implies accelerated expansion onsets while we assume time t in Eq. (11) presents the age of Universe while as discussed in [17], Cai agegraphic model cannot onsets accelerated expansion.

As remarks, following Karolyhazy pioneer study and Maziashvili argument, the effective energy density of quantum fluctuations of space-time for generalized uncertainty principle (1) is derived. This new energy density has two parts, first one is same term found by Maziashvili [15], while second part arises from extra term in relation (1). As shown, exploring dark energy when t replaced with age of the Universe shows even in absence of matter field our agegraphic dark energy evolves with time. Moreover, late-time evolution of the Universe is studied while second term in generalized uncertainty principle (1) gives the origin of interaction between dark energy and matter. This new generalized agegraphic model can begin accelerated phase in late-time. Moreover, since α gets negatives values, the standard Heisenberg uncertainty relation is upper bound of relation (1).

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The Using of Some Nanoparticles in Chiral Analysis with Different Methods of Separation

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Abstract

Chiral molecules in relation to particular biological roles are stereoselective. Enantiomers differ significantly in their biochemical responses in biological environment. Despite the current advancement in drug discovery and pharmaceutical biotechnology, the chiral separation of some racemic mixtures continues to be one of the greatest challenges, because the available techniques are too costly and time consuming for the assessment of therapeutic drugs in the early stages of development worldwide. Various nanoparticles became one of the most investigated and explored nanotechnology-derived nanostructures especially in chirality where several studies are reported to improve enantiomeric separation of different racemic mixtures. The production of surface-modified nanoparticles has contributed to these limitations in terms of sensitivity, accuracy, and enantioselectivity that can be optimized and therefore makes these surface-modified nanoparticles convenient for enantiomeric identification and separation.

Keywords: chirality, enantiomeric recognition, selectors, analysis, surface-modified nanoparticles.

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Coronin 1C and miR-128A as Potential Diagnostic Biomarkers for Glioblastoma Multiform

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***Abstract*—** Glioblastoma multiform (GBM) is a heterogenous primary brain tumour that kills most affected patients. To the authors best knowledge, despite all research efforts there is no early diagnostic biomarker for GBM. MicroRNAs (miRNAs) are short non-coding RNA molecules which are deregulated in many cancers. The aim of this research was to determine miRNAs with a diagnostic impact and to potentially identify promising therapeutic targets for glioblastoma multiform. In silico analysis was performed to identify deregulated miRNAs with diagnostic relevance for glioblastoma. The expression profiles of the chosen miRNAs were then validated in vitro in the human glioblastoma cell lines A172 and U-87MG. Briefly, RNA extraction was carried out using the Trizol method, whilst miRNA extraction was performed using the mirVANA miRNA isolation kit. Quantitative Real-Time Polymerase Chain Reaction was performed to verify their expression. The presence of five target proteins within the A172 cell line was evaluated by Western blotting. The expression of the CORO1C protein within 32 GBM cases was examined via immunohistochemistry. The miRNAs identified in silico included miR-21-5p, miR-34a and miR-128a. These miRNAs were shown to target deregulated GBM genes, such as CDK6, E2F3, BMI1, JAG1, and CORO1C. miR-34a and miR-128a showed low expression profiles in comparison to a control miR-RNU-44 in both GBM cell lines suggesting tumour suppressor properties. Opposing, miR-21-5p demonstrated greater expression indicating that it could potentially function as an oncomiR. Western blotting revealed expression of all five proteins within the A172 cell line. In silico analysis also suggested that CORO1C is a target of miR-128a and miR-34a. Immunohistochemistry demonstrated that 75% of the GBM cases showed moderate to high expression of CORO1C protein. Greater understanding of the deregulated expression of miR-128a and the upregulation of CORO1C in GBM could potentially lead to the identification of a promising diagnostic biomarker signature for glioblastomas.

***Keywords*—** non-coding RNAs, gene expression, brain tumours, immunohistochemistry.

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"Black Book": Dutch Prototype or Jewish Outsider

Eyal Boers

***Abstract*—** This paper shall demonstrate how films can offer a valuable and innovative approach to the study of images, stereotypes, and national identity. "Black Book" ("Zwartboek", 2006), a World War Two film directed by Paul Verhoeven, tells the story of Rachel Stein, a young Jewish woman who becomes a member of a resistance group in the Netherlands. The main hypothesis in this paper maintains that Rachel's character possesses both features of the Dutch prototype (a white, secular, sexual, freedom-loving individualist who seems "Dutch" enough to be accepted into a Dutch resistance group and even infiltrate the local Nazi headquarters) and features which can be defined as specifically Jewish (a black-haired victim persecuted by the Nazis, transforming herself into a gentile, while remaining loyal to her fellow Jews and ultimately immigrating to Israel and becoming a Hebrew teacher in a Kibbutz). Finally, this paper claims that Rachel's "Dutchness" is symptomatic of Dutch nostalgia in the 21st century for the Jews as "others" who blend into dominant Dutch culture, while Rachel's "Jewish Otherness" reflects a transnational identity – one that is always shifting and traverses cultural and national boundaries. In this sense, a film about Dutch Jews in the Second World War reflects on issues of identity in the 21st Century.

***Keywords*—** Dutch, film, stereotypes, identity.

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Identification of Information War in Lithuania

Vitalijus Leibenka

***Abstract*—** After 2014, the world of Russia's actions in annexing Crimea has seen a hybrid war that has helped Russia achieve its goals. The world and NATO nations have pointed out that hybrid action can help achieve not only military but also economic and political goals. One of the weapons of action in hybrid warfare is information warfare tools, the use of which helps to carry out actions in the context of hybrid warfare as a whole. In addition, information war tools can be used alone, over time, and for long-term purposes. Although forms of information war, such as propaganda and disinformation, have been used in the past, in old conflicts and wars, new forms of information war have emerged as a result of technological development, making the dissemination of information faster and more efficient. The world understands that information is becoming a weapon, but not everyone understands that both information war and information warfare differ in their essence and full content. In addition, the damage and impact of the use of information war, which may have worse consequences than a brief military conflict, is underestimated. Lithuania is also facing various interpretations of the information war. Some believe that the information attack is an information war, and the understanding of the information war is limited to a false message in the press. Others, however, deepen and explain the essence of the information war. Society has formed in such a way that not all people are able to assess the threats of information war, to separate information war from information attack. Recently, the Lithuanian government has been taking measures in the context of the information war, making decisions that allow the development of the activities of the state and state institutions in order to create defense mechanisms in the information war. However, this is happening rather slowly and incompletely. Every military conflict related to Lithuania, in one way or another, forces Lithuanian politicians to take up the theme of information warfare again. As a result, a national cyber security center is being set up, and Russian channels spreading lies are banned. However, there is no consistent development and continuous improvement of action against information threats. Although a sufficiently influential part of society (not a political part) helps to stop the spread of obscure information by creating social projects such as "Demaskuok" and "Laikykis ten su Andriumi tapinu", it goes without saying that it will not become a key tool in the fight against information threats. Therefore, in order to achieve clean dissemination of information in Lithuania, full-fledged and substantial political decisions are necessary, the adoption of which would change the public perception of the information war, its damage, impact, and actions that would allow combating the spread. Political decisions should cover the educational, military, economic, and political areas, which are one of the main and most important in the state, which would allow to fundamentally change the situation against the background of information war.

***Keywords*—** information war, information warfare, hybrid war, NATO, Russia, Lithuania.

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Latitudinal Patterns of Pre-industrial Human Cultural Diversity and Societal Complexity

Xin Chen

***Abstract*—** Pre-industrial old-world human cultural diversity and societal complexity exhibits remarkable geographic regularities. Along the latitudinal axis from the equator to the arctic, a descending trend of human ethno-cultural diversity is found to be in coincidence with a descending trend of biological diversity. Along the same latitudinal axis, the pre-industrial human societal complexity shows to peak at the intermediate latitude. It is postulated that human cultural diversity and societal complexity are strongly influenced by collective learning, and that collective learning is positively related to human population size, social interactions, and environmental challenges. Under such postulations the relationship between collective learning and important geographical-environmental factors, including climate and biodiversity/bio-productivity is examined. A hypothesis of intermediate bio-productivity is formulated to account for those latitudinal patterns of pre-industrial human societal complexity.

***Keywords*—** cultural diversity, soetal complexity, latitudinal patterns, biodiversity, bio-productivity, collective learning.

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Bloodline Rwanda: Going Beyond Perpetration a Comprehensive Analysis of Scholarly Research on Rwandan Women as Perpetrators of Genocide.

Jess Larin

***Abstract*—** The Rwandan genocide of 1994 was one of the most horrendous crimes against humanity. The propension of the violence has never been equaled in any other genocide. The length of time— about 3 months— it took for the Hutu extremists to eradicate between 500,000 and 800,000 individuals, mainly Tutsis, was the main horror of this crime. Many Hutu "Moderates"—Hutus who did not believe that Tutsis were completely "evil"— were also victimized. The following is an attempt to bridge a gap in the literature of perpetrator studies. This gap is in part caused by scholars' lack of focus on female perpetrators of genocidal violence along with the voluntary use of gender normativity and gender performances of perpetrators in these studies. The need for a neutral frame of analysis in order to better understand how gender normativity and performance interlocks with crimes against humanity is therefore paramount. The neutral frame of analysis provides the scholar with a means to understand how the gender of the perpetrator and of the victim, as well as gender normativity of the given society and its performance interact with the actions. When put in context with the individual and not the crime itself the neutral frame of analysis also provides a better understanding of how the crimes committed—i.e: rape and female disfigurement— affects the society and not only the individuals. The analysis of perpetrator-focused studies on the Rwandan genocide along with other disciplines such as: anthropology, history, sociology, psychology, and feminist studies, will highlight the exclusion of female perpetrators. The analysis of the gendering of perpetrators in genocide studies in this exercise will bring to light the need for further investigation and an improved framework.

***Keywords*—** Africa, History, Gender, Genocide.

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Creating Culturally Competent Teachers by Providing Teach Abroad Preservice Experiences

Sherie Klee

***Abstract*—** The need for more culturally competent teachers is rising in today's world. Today, schools and colleges of education are preparing professionals to teach in a world that is much more connected regarding international perspectives than in the past. The teachers prepared for tomorrow's classrooms will need the knowledge and skills to serve a more diverse population of students. To discover the effect a culturally diverse teaching experience has on student teachers, a qualitative study was completed with former preservice teachers from a Midwestern university who participated in the Consortium of Overseas Student Teaching (COST) and had the opportunity to actually teach rather than simply studying abroad. This study showed that placing students in diverse teaching experiences during their preservice period enhanced their cultural competency. Also, this type of training influenced these teachers in their future classrooms by enhancing their cultural competency and teaching practices. This in turn, impacts future generations of learners and helps provide cultural acceptance of all students. The objective of this research was to investigate whether teaching abroad during teacher preparation enhance teacher cultural competency. Additionally, does teaching abroad during preservice preparation change participants' classroom practices. Qualitative data from former preservice teachers via interviews and surveys were used. The data collected were organized by recurring themes and analyzed using open coding. Participating in teach abroad programs during teaching preparation enhances the cultural competency of teachers and positively impact their future teaching.

***Keywords*—** cultural awareness, cultural competence, preservice teachers, teacher preparation, teaching practices.

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Before Decision: Career Motivation of Teacher Candidates

Pál Iván Szontagh PhD. [1]

Abstract

We suppose that today, the motivation for the *career* of a pedagogue (including its existential, organizational and infrastructural conditions) is different from the level of commitment to the *profession* of an educator (which can be experienced informally, or outside of the public education system). In our research, we made efforts to address the widest possible range of student elementary teachers, and to interpret their responses using different filters. In the first phase of our study, we analyzed first-year kindergarten teacher students' career motivation and commitment to the profession, and in the second phase, that of final-year kindergarten teacher candidates. In the third phase, we conducted surveys to explore students' motivation for the profession and the career path of a pedagogue in four countries of the Carpathian Basin (Hungary, Slovakia, Romania and Serbia). The surveys were conducted in 17 campuses of 11 Hungarian teacher's training colleges and universities. Finally, we extended the survey to practicing graduates preparing for their on-the-job rating examination. Based on our results, in all breakdowns, regardless of age group, training institute or - in part - geographical location and nationality, it is proven that lack of social- and financial esteem of the profession poses serious risks for recruitment and retention of teachers.

As a summary, we searched for significant differences between the professional- and career motivations of the three respondent groups (kindergarten teacher students, elementary teacher students and practicing teachers), i.e. the motivation factors that change the most with education and/or with the time spent on the job.

Based on our results, in all breakdowns, regardless of age group, training institute or - in part - geographical location and nationality, it is proven that lack of social- and financial esteem of the profession poses serious risks for recruitment and retention of teachers.

Keywords: career motivation, career socialization, professional motivation, teacher training.

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Comprehension Instruction for Elementary Students: A Literature Review

Mahdi Taheri Asl, Mohammad Setayeshi

***Abstract*—** Comprehension instruction have been shown to improve students' Comprehension skills. Yet, there has been limited research on it which are more likely to be sustainable in a classroom. The purpose of this review was to examine the effectiveness of comprehension instruction in regular-classroom environments with elementary-aged students. The inclusion criteria resulted in the identification of 13 experimental research studies. However, explicit strategy instruction, including self-regulated strategy development, was the most commonly used approach that improved students' comprehension achievement. Practical implications of the results are discussed and directions for future research are provided.

***Keywords*—** comprehension, metacognitive process, comprehension instruction, metacognitive strategies.

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Effectiveness of Metacognitive Skills in Comprehension Instruction for Elementary Students

Mahdi Taheri Asl

***Abstract*—** Using a variety of strategies to read text plays an important role to make students strategic independent, strategic, and metacognitive readers. Given the importance of comprehension instruction (CI), it is essential to support the fostering comprehension skills at elementary age students, particularly those who struggle with or dislike reading. One of the main components of CI is activating metacognitive skills, which double function of elementary students. Thus, it's important to evaluate the implemented comprehension interventions to inform reading specialist and teachers. There has been limited review research in the area of CI, so the conduction review research is required. The purpose of this review is to examine the effectiveness of metacognitive reading strategies in a regular classroom environment with elementary aged students. We develop five inclusion criteria to identify researches relevant to our research. First, the article had to be published in a peer-reviewed journal from 2000 to 2023. second, the study had to include participants in elementary school it could include of special education students. Third, the intervention needed to be involved with metacognitive strategies. Fourth, the articles had to use experimental or quasi experimental design. The last one needed to include measurement of reading performance in pre and post intervention. We used computer data-based site like Eric, PsychoINFO, and google scholar to search for articles that met these criteria. we used the following search terms: comprehension instruction, meta cognitive strategies, and elementary school. The next step was to do an ancestral search that get in reviewing the relevant studies cited in the articles that were found in the database search. We identified 30studies in the initial searches. After coding agreement, we synthesized 13 with respect to the participant, setting, research design, dependent variables, measures, the intervention used by instructors, and general outcomes. The finding show metacognitive strategies were effective to empower student's comprehension skills. It also showed that linguistic instruction will be effective if got mixed with metacognitive strategies. The research provides a useful view into reading intervention. Despite the positive effect of metacognitive instruction on students' comprehension skills, it is not widely used in classroom.

***Keywords*—** comprehension instruction, metacogntion, metacognitive skills, reading intervention.

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Distributive Justice through Constitution

Rohtash

***Abstract*—** Academically, the concept of Justice in the literature is vast, and theories are voluminous and definitions are numerous but it is very difficult to define. Through the ages, justice has been evolving and developing reasoning that how individuals and communities do the right thing that is just and fair to all in that society. Justice is a relative and dynamic concept, not absolute one. It is different in different societies based on their morality and ethics. The idea of justice cannot arise from a single morality but interaction of competing moralities and contending perspectives. Justice is the conditional and circumstantial term. Therefore, justice takes different meanings in different contexts. Justice is the application of the Laws. It is a values-based concept in order to protect the rights and liberties of the people. It is a socially created concept that has no physical reality. It exists in society on the basis of the spirit of sharing by the communities and members of society. The conception of justice in society or among communities and individuals is based on their social coordination. It can be effective only when people's judgments are based on collective reasoning. Their behavior is shaped by social values, norms and laws. People must accept, share and respect the set of principles for delivering justice. Thus justice can be a reasonable solution to conflicts and to coordinate behavior in society. The subject matter of distributive justice is the Public Good and societal resources that should be evenly distributed among the different sections of society on the principles developed and established by the State through legislation, public policy and Executive orders. The Socioeconomic transformation of the society is adopted by the constitution within the limit of its morality and gives a new dimension to transformative justice. Therefore, both Procedural and Transformative justice is part of Distributive justice. Distributive justice is purely an economic phenomenon. It concerns the allocation of resources among the communities and individuals. The subject matter of distributive justice is the distribution of rights, responsibilities, burdens and benefits in society on the basis of the capacity and capability of individuals.

***Keywords*—** distributive justice, constitutionalism, institutionalism, constitutional morality.

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The Influence of Positive and Negative Affect on Perception and Judgement

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Abstract

Modern psychology is divided into three distinct domains: cognition, affect, and conation. Historically, psychology devalued the importance of studying the effect in order to explain human behavior as it supposedly lacked both rational thought and a scientific foundation. As a result, affect remained the least studied domain for years to come. However, the last 30 years have marked a significant change in perspective, claiming that not only is affect highly adaptive, but it also plays a crucial role in cognitive processes. Affective states have a crucial impact on human behavior, which led to fundamental advances in the study of affective states on perception and judgment. Positive affect and negative affect are distinct entities and have different effects on social information processing. In addition, emotions of the same valence are manifested in distinct and unique physiological reactions indicating that not all forms of positive or negative affect are the same or serve the same purpose. The effect plays a vital role in perception and judgments, which impacts the validity and reliability of memory retrieval. The research paper analyzes key findings from the past three decades of observational and empirical research on affective states and cognition. The paper also addresses the limitations connected to the findings and proposes suggestions for possible future research.

Keywords**:** memory, affect, perception, judgement, mood congruency effect.

The Influence of Positive and Negative Affect on Perception and Judgment

The cognitive approach in psychology studies human cognitive processes including memory, perception and attention. Research has shown that both positive and negative affective states play an influential role in a variety of psychological phenomena. Yet, historically psychological discourse has both overlooked the importance of understanding human affective states and undervalued the relationship between affect and cognition. The exclusion of affect in earlier psychological literature was a direct reflection of the Western belief that “affect is dangerous, invasive force that subverts rational thinking (Forgas 2008). As a result, the study of affect was deemed scientifically futile and incapable of explaining human mental processes. However, this belief drastically changed in recent years and researchers now recognize the pivotal bearing affective states have on human behavior and their role in how mental representations are stored in memory. Affect coupled with heightened emotional states impact the activation of unconscious automatic cues that shape behavior, perception and judgments.

Affective states and cognitive processes play an integral role in human behavior. Russell and Feldman-Barrett (2009) defined affect as a "neurophysiological state consciously accessible as a simple primitive non-reflective feeling most evident in mood and emotion but always available to consciousness". The intensity of affective states filters how a memory is encoded and

ultimately retrieved. Ekman (2007) stated that the evolving nature of affect allows for possible adaptation to surroundings. It is not just evolution that determines emotional responses, but it is also the past and present experiences that shape affective states and reactions. Forgas (2008) highlighted that recent research in neuroscience supports the idea that both social cognitive and affective states share similarities particularly in regards to sharing overlapping neural structures. Research has focused on two psychological phenomena with a great deal of interest: mood-dependency effect which states that people are more likely to recall events in the same mood the event was learned and encoded, and mood-congruency effect which claims that people attend to events that match their emotional state. According to these models, affect activates concepts in memory that are closely linked with the affective state. However, affect intensity further impacts perception and overall judgment of that memory and can lead to misrepresentation and biases. In addition, the semantic-network theory reflects a connection between mood and cognitive processes. The theory suggests that humans mentally store information in a hierarchy dependent on their meanings which in turn leads to more effective recall of information. Bower (1981) stated that the semantic-network approach supposes that distinct emotions have a specific node or unit in memory, collecting other aspects of the emotion that are connected to it by associative pointers. Activation of an emotion also activates the memory structures to which it is connected. For example, a vague cue like "sports" may result in activating a specific emotional node in order to retrieve a relevant memory. People experiencing a particular emotional state like anger versus sadness will become conscious that they are thinking of that particular word and will recall either angry or sad events associated with sports. The reactivation of the angry or sad memory will persist and impact memories retrieved in the future (Bower 1981). The study of affect has further resulted in the idea that emotions precede thought and that before the rational and logical aspect of the brain can analyze a situation a feeling has already been formed.

Feelings precede cognition. Evidence shows that the neurological structures for emotional expression are associated with the primitive brain and developed long before cognition evolved (Masey 2002). Research has suggested that emotion is composed of different subcomponents and "is best understood not as a single monolithic process but rather as a set of differentiated subcomponents that are instantiated in a distributed network of cortical and subcortical circuits" (Davidson 2003). However, Duncan and Feldman-Barrett (2007) have argued that affect is a form of cognition and therefore should not be regarded as two independent concepts. However, the theory lies short of realistic evidence and fails to explain how affect can be regarded as a subcomponent of cognitive. Evidence shows clear distinctions between affect and cognition which has repeatedly been demonstrated through empirical evidence; affect refers to an emotional phenomenon while cognition refers to rational appraisal (de Haes, de Ruiter, Tempelaar & Pennink 1992). Sensory information streams into the limbic brain but by the time information reaches the cerebral cortex for logic processing a feeling has already been encoded (Swenson 2006). Emotions are visceral and are built-in to motor memory. Unlike other types of memory, motor memory or skill memory moves from short-term to long-term at a much faster pace making it less likely to forget a certain skill that has been firmly encoded. Loewenstein and Lerner (2003) found that incidental emotions can carry over from one situation to the next, resulting in behavior unrelated to that emotion. When an individual experiences a feeling of anger in one situation, they automatically experience a motive to blame individuals in the next situation, even though the two events are unrelated and the source of the initial anger does not match the target of the anger. One tends to be completely unaware of this emotional transference which further impacts one's judgement in a completely different and unrelated situation. During

intense emotional states individuals often recall experiencing a state of powerlessness as if they were "out of control" or "acted against their own self-interest" (Loewenstein & Lerner (2003). High intensity emotions can prove to be overwhelming, distort people's judgments and may elicit maladaptive behaviors that despite having high cognitive resources and rational capacities still occur. Loewenstein and Lerner (2003) have shown that experiencing intense emotional states hindered the effectiveness of information processing and allowed for systematic errors to occur when forming judgments or predicting consequences. In another study, Gasper and Clore (1998) examined the link between anxiety and participants' assumptions of their experiences of state anxiety for judgments of risk. Researchers claimed that individuals with severe anxiety relied on incidental feelings of state anxiety as a guiding tool for future judgements, even if the individual recognized that their anxious state was a product of a judgement-irrelevant source. Schwarz (1990) suggested that, "affect congruence in judgments is caused by an inferential error. Individuals may ask themselves a simple question: "How do I feel about it?", however the answer is not as simple for often times they mistake preexisting feelings as a reaction to the target. A fundamental concern for reliability emerges even when asking this simple question because the answer, for the most part, will be a direct reflection of one's current affective state. Zajonc (1980) proposed the idea that causes of emotion can be unconscious but the emotional state tends to be conscious. Nevertheless, Zajonc later modified his initial hypothesis and claimed that subjects in affective priming experiments do not experience conscious affect, but instead act on basic preferences.

Positive and negative affective states shape perception and judgments. Perception arises from current affective states coupled with preexisting and primed knowledge structures. When an individual first encodes a memory, personal reactions and beliefs about the event are automatically incorporated. As a result, memory distorts and misrepresents the event to such a degree that its validity becomes a concern. Forgas (2008) suggested that happy people are more confident, hold better moral judgment, have better integrative thinking and negotiation skills unlike individuals in a negative state. Fredrickson and Branigan (2005) explored the broaden-and-build theory which claimed that positive affect broadens awareness and over time builds skills and resources. The study used Emotion Report Forms to document the emotion the participants were experiencing at the moment. The participants then viewed a short video clip, set up to elicit an emotional response. The experiment consisted of two experimental trials where the university students were randomly assigned to watch a video clip and then complete the forms. The results revealed that positive emotions were strongly correlated with broader scopes of awareness while negative or even neutral emotions did not reflect the idea of "broadening". Broadening has the ability to alter thoughts and feelings, which means that positive affect can fundamentally alter one's affective states and cognitive processes. Kavanagh and Bower (1985) investigated the impact of both happy and sad moods on efficacy judgments in relation to a variety of tasks. The experiment aimed to induce mood by asking hypnotized respondents to recall a personal romantic success or weakness and then describe their respective feelings and emotions. Evidence revealed that emotional states significantly impacted judgments by increasing the accessibility of mood-congruent thoughts. Inducing either a happy or sad mood by recalling a past romantic success or failure lead to the respondent's perceived efficacy for a multitude of romantic activities and interpersonal skills. The content of recalled memories reflected the individualistic nature of the participants as well as their level of abilities. In another study, van Baaren, Holland, Kawakami, and van Knippenberg (2004) had students interact with an experimenter who either subtly mimicked the behavior of the students or did not mimic the

students. The participants who had been mimicked demonstrated more helpful behavior towards other participants as opposed to the non-mimicked participants. The results suggested that mimicry increased prosocial behavior associated with positive moods on helping. Schwarz and Clore (1983) conducted two experiments that explored the impact of mood-related factors on happiness and life satisfaction. The first experiment asked participants to describe a recent happy or sad event. The experimenter found that participants who described happy events reported increased positive affect while participants who were asked to share a negative event reported decreased positive affect. The evidence supported the mood congruency effect, suggesting that individuals were more likely to selectively recall details of an event consistent with one's current mood. The second experiment investigated the notion of well-being by running a series of telephone interviews either on warm and sunny days or on rainy days. Similar findings were found in both experiments as participants reported feeling increased happiness and overall life satisfaction under positive conditions. Evidence suggested that people use current affective states when making judgments about their level of happiness and overall life satisfaction.

Positive and negative affect are not polar opposites – it is more nuanced than researchers had originally thought. Research shows that positive and negative affective states are independent of one another and that "a person can be both happy and sad, or even unhappy and not sad" at the same time (Zautra, Potter & Reich 1997). Ashby, Isen and Turken (1999) introduced the dopaminergic theory of positive affect which highlighted the correlation between positive affect and increased dopamine levels in the brain. The theory showed how positive affect influenced performances on a variety of cognitive tasks, improved social interaction, helped with memory and creative problem solving. The findings revealed that dopamine levels in the brain increased when an individual was presented with a reward resulting in positive affect however reducing dopamine levels in the brain did not lead to negative affect, instead it created a state of anhedonia (a loss of pleasure or flattened affect). Ashby, Isen and Turken (1999) further highlighted that stressful or anxiety provoking situations normally associated with eliciting negative affect actually increased dopamine levels in certain areas of the brain. The findings underlined that positive affect and negative affect were not opposites and were localized in different cerebral hemispheres.

Positive and negative affective states are distinct entities with distinct meanings and motivational implications. Harmon-Jones and Sigelman (2001) demonstrated that anger was associated with relative left-prefrontal cortical activity. The findings also revealed asymmetrical prefrontal cortical activity reflected motivational direction instead of emotional valence. Emotions of the same valence (e.g. anger and sadness) are associated with different brain hemispheric activation, facial expression sand autonomic responses. In addition, studies showed that specific positive emotions, such as gratitude and pride, had different effects on helping behavior and task perseverance. Lerner and Keltner (2001) proposed an appraisal-tendency framework and found that fear and anger had opposite effects on risk perception. The results showed that fearful people were more likely to express pessimistic risk estimates while angry people expressed optimistic risk-seeking choices. Fear and anger are defined by different appraisals of certainty and control, thus fear and anger activated different perceptions of risk. In addition, "emotions trigger changes in cognition, physiology, and action that, although tailored to help the individual respond to the event that evoked the emotion, often persist beyond the eliciting situation" (Lerner & Keltner 2001). Raghunathan and Pham (1999) asked participants to experience the events described in a particular scenario and to imagine what they would feel like if they were in that situation. The participants were then given a questionnaire and asked to

assess their current emotional state. The results demonstrated that sadness increased reward-seeking behavior, compared to anxiety, disgust or even happiness. Thus, negative affective states are not all equal in decision making. Bodenhausen, Sheppard and Kramer (1994) explored the possibility that different kinds of negative affect (angry and sad emotional states) can have very different effects on social information processing. The results showed that different negative affective states are manifested in distinct and unique physiological reactions. Anger shows activity in the amygdala - part of the brain responsible for processing emotions, while sadness is activated in the hippocampus which turns short term memory into long term memory. The results revealed that both angry and sad participants showed clear differences in social information processing. Angry participants relied more on simple cues when reacting to social stimuli and their judgments were affected by social stereotypes while sad participants relied more on thoughtful and detail-oriented cues. This can be further explained by the mood congruency effect which asserts that if one is angry or sad at a given moment they are less likely to remember the positive aspects and focus entirely on the negative aspects of that event. The studies revealed that sad individuals processed social information more systematically while angry individuals appeared to be less systematic and expressed more agonistic behavior resulting in more impulsive reactions. Depressive affect influences behavior and judgments, manifesting in various negative psychological symptoms including self-critique and feelings of inadequacy. Individuals perceive the world through a negative lens resulting in a distorted and misrepresented sense of reality. Affect controls perception while the idea of "reality" depends on the "lens" used to view the world. In addition, mood and self-efficacy are highly correlated and a key determinant in the prevalence of depression. Kanfer and Zeiss (1983) observed interpersonal functioning in both depressed and non-depressed participants in order to examine the relationship between standard setting and judgments of self-efficacy. Results revealed that the lowering of self-efficacy in a depressed mood was more likely to depress mood even further, especially if individuals showed signs of unrealistically high performance standards. The findings suggested that rates of failure will increase whilst the rates of success will decrease and, if the problem is left untreated, will only foster the progression of depressive states and lead to the gradual decay of self-efficacy. Affect and mood impacts human behavior and plays a central role in perception and judgments.

Behavioral consequences of automatic activation of unconscious cues are accentuated by heightened emotional states. Bargh, Chen and Burrows (1996) primed participants with politeness and rudeness and found that the group in the rudeness category displayed more hostile behavioral consequences and were more likely to interrupt. The study suggests that behaviors and attitudes, like stereotypes can essentially be primed especially when a participant is experiencing a heightened emotional state. Hence, affective states shape judgment and social behavior which can ultimately lead to categorization. Johnson and Tversky (1983) investigated the role of affect in judgments of risk. The participants read newspaper stories designed to induce positive or negative affect and then estimated the frequency of potential causes of death. The findings demonstrated that the participants who read the negative stories presented more negative estimates of fatalities. The research exposed the current affective states impact judgments, even when the subject matter has no relation to the cause of that mood. In another study, Dasgupta, Desteno, Williams and Hunsinger (2009) investigated the impact of incidental emotions on implicit intergroup evaluations and found that incidental disgust (but not anger) increased implicit prejudice against gays and lesbians while incidental anger (but not disgust) increased implicit prejudice against Arabs. These findings suggested that negative intergroup emotions signal specific types of threat. If an individual unconsciously associates a specific demographic

of people with violence or aggression they are more likely to display negative affect towards that group. As a result, “Shooter Bias” becomes more automatic and prevalent, particularly in moments of severe stress, arousal and high intensity emotional states. Research has systematically exposed an evident bias for white individuals to target unarmed black targets than unarmed white targets (Correll, Park, Judd & Wittenbrink 2002). This is a serious cause for concern particularly in regards to police officers where automatic activation of implicit biases and prejudice are accentuated during moments of intense emotional states like stress, fear or anger. At the moment, research does not suggest a possible resolution, however the presence of cognitive resources and motivation to change can help alleviate stereotype behaviors and potentially decrease implicit biases subsequently leading to a more integrated society.

Discussion

The evidence presented supports the claim that affective states impact the activation of unconscious automatic cues that shape behavior, perception and judgments. In doing so, the evidence has identified the subjective and biased qualities associated with human memory. Memory acts as a memoire of perceived past events retold through a filter of our own “truth” in conjunction with preexisting biases and imagination. For this exact reason, reconstructed memory serves almost no purpose in court proceedings and eye-witness testimony leading to false identification and wrongful imprisonment of predominantly innocent people. Affective states and perception mold human memory in a way that impairs the validity of our judgments and ultimately serve as a beacon of subjectivity and reconstructed history.

Although the validity of the studies presented appear strong, some study limitations merit comment. Research has predominantly focused on the mentality of the West using participants of Caucasian descent whilst neglecting to incorporate participants of other racial and cultural backgrounds. In order to increase credibility, researchers must start to develop studies that compare individuals of different racial, cultural and economic backgrounds instead of solely focusing on a specific demographic. Affective states have namely been measured using self-report questionnaires, which due to their qualitative nature may result in participant bias. Attention should now be placed on controlling the participant sample, refining rating scales and decreasing response bias by instilling both a judgement-free environment and a sense of confidentiality to ensure honest and reliable responses from the participants which may dilute some of the previously mentioned limitations.

Future research should continue to examine the influence of positive and negative affective states on perception and judgment to gain a better understanding of human cognitive processes. However, the study of affect is not a singular construct, with a singular theory, instead it encompasses countless theoretical views that must be incorporated in future studies in order to broaden the understanding of human behavior. Measuring affective constructs remains challenging and involves significant planning to ensure the validity of future studies. Researchers must develop both an effective theoretical framework which would address the countless emotional experiences on human behavior and incorporate an appropriate conceptual model of the construct of interest. Research on the impact of affect is boundless and will advance a myriad of other fields including health psychology, public policy and the judicial system.

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A Review of Factors Associated with Patterns of Drinking During Pregnancy

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***Abstract*—**

Purpose: To identify factors associated with drinking patterns during pregnancy.

Design: A rapid evidence assessment was undertaken, scanning multiple databases for studies examining factors associated with alcohol consumption in pregnancy. Studies were included if they stratified data according to the quantity of alcohol consumed and identified relevant associated factors. Drinking patterns were classified as light/moderate and heavy/binge.

Findings: Fifteen studies were included (N=7 light/moderate; N=15 heavy/binge drinking). Factors associated with alcohol consumption during pregnancy included: smoking, age, SES, marital status, pre-pregnancy substance use, and parity. While few studies reported an association between heavy/binge drinking and maternal mental health, none of the studies included explored the association between mental health and light/moderate drinking.

Research limitations/implications: Relatively few studies have looked at the association between the psychological characteristics of women and their drinking patterns. There is a lack of articles examining light/moderate drinking in pregnancy compared to heavy/binge drinking. Moreover, there is a marked variation in how alcohol use is measured. Further studies are needed to increase understanding of the association between psychological factors and patterns of drinking during pregnancy, and how health professionals might support women in this context.

Originality/value: We expand on previous work by examining two different patterns of alcohol consumption in pregnancy rather than alcohol use simply as an isolated concept. The two groups were found to differ in a number of demographic and social factors. This information could be used to aid healthcare professionals in targeting specific interventions for those women most at risk.

***Keywords*—** drinking patterns, pregnancy, risk factors, rapid evidence assessment.

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Expression Evaluation of Cell Cycle Regulatory Genes (P27, P21, P14) in AML Patient

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Abstract

Introduction: Cell cycle control has a critical role in normal haematopoiesis, leukomogenesis can affect key cell cycle regulators such as CDI gene family. P27, P21 and P14 in CKI family are frequently involved in AML. Their defects disrupt the balance between proliferation and apoptosis which can be led to cancer formation.

Objectives: The present study aimed at expression investigation of such essential cell cycle proteins (P21, P27, P14) in bone marrow biopsies and peripheral blood obtained from newly diagnosed acute myeloid leukaemia patients.

Methods: The results of present study obtained from bone marrow and peripheral blood sample of 93 newly diagnosed AML patients (39 males and 54 female classified in 3 age group ;< 35, 35-60 and >60 years old) obtained from Taleghani hospital. We have 45 APL patient and 48 Non M3 patient. In addition, expression of target genes was detected compared with ABL as housekeeping gene using the ΔΔCT method.

Results: P21 and P27 had 1.44 and 4.10 higher expression respectively in comparison with normal control group (PV>0.05), and average expression fold change of P14 compared with the control group was 3.69 that shown significant reduction (Pv>0.05). We found no correlation between expression level of the mentioned genes and common AML prognostic factors including: age, gender, blast cell type and even sample type.

Conclusion: We hypothesized that at the first step they get rid from their anti-tumour function and at the second step the malignant cells employ these proteins at their service.

Keywords: AML, Regulatory cell cycle proteins, P27, P21, P14, Expression evaluation.