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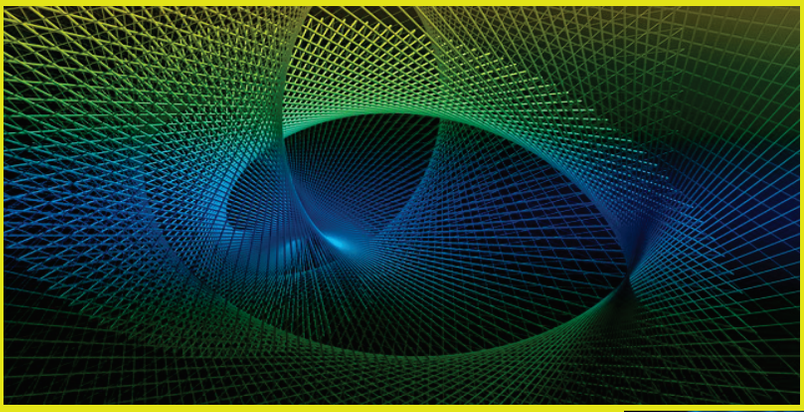

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CONTENTS

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Keynote Speaker

Dr. T.M. Chaudhry
Former Researcher, Biological Sciences, Western Sydney University, NSW, Australia

Topic: Practical Application of Mycorrhizoremediation in Phytoremediation of Heavy Metal Contaminated Soils

Dr Tariq Chaudhry (Retired) is an academic, researcher and naturopathic consultant. He completed his PhD at Western Sydney University (WSU), Australia in 1999. He was one of the pioneer Australian researchers in the field of heavy metal phytoremediation and mycorrhizoremediation. He identified heavy metal hyperaccumulator plants including medicinal plants from two heavy metal contaminated sites and studied the role of fungus mycorrhizae to enhance phytoremediation during his research at WSU, Australia. His research was acknowledged by the Australian Society for Microbiology (ASM) and shortlisted for the Becton Dickinson Award (1999). He also received awards in other research fields during the course of his academic career. He has presented his work at national and international conferences and published in numerous journals. He is a member of the Complementary Medicine Association, Australia (CMA) and a guest member of the Society of Environmental Toxicology and Chemistry (SETC), USA. His research in the area of environmental science, nutrition, and complementary medicine (including environmental medicine) have allowed him to advise his clients on hazardous environmental factors that give cause to diseases in the human living condition, broadening his passion for holistic health care.

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Invited Speaker

Professor. Dr.(Mrs). Rajeswari Seshadri
Department of Mathematics, Pondicherry University, India.

Topic: Spread of HIV infection and its remedial measure using Drug Therapy - A Mathematical Analysis

Dr. Rajeswari Seshadri is a Ph.D. holder in Mathematics from the one and only Indian Institute of Science, Bangalore in India. She has a vast teaching and research experience of more than 29 years. She has a unique under graduate degree B.Sc.Ed. (A four year Integrated Course in B.Sc. and B.Ed.) with Mathematics, Physics and Chemistry majors and the post graduate degree M.Sc.Ed. in Mathematics from the Regional Institute of Education, Mysore, Karnataka, India. She is a Rank holder in both the undergraduate and post graduate courses securing 5th rank in B.Sc.Ed. and 1st Rank in M.Sc.Ed. from Mysore University. Dr. Rajeswari has a post-doctoral experience having worked in three foreign universities such as St. Andrews University-Scotland-UK, Djursholm University-Stockholm - SWEDEN and Queen Mary, University of London, UK and at another prestigious research institute Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bangalore, INDIA. She has worked in Manonmaniam Sundaranar University, Tirunelveli as a Lecturer and in Sir M Visvesvaraya Institute of Technology, Bangalore as Professor in Mathematics before joining Pondicherry University. She has served as a Dean, Students Welfare of Pondicherry University from 2015 to 2018.Dr. Rajeswari has several Fellowships and awards to her credit. To name a few are: CSIR – Senior Research Fellowship and CSIR – Research Assistance ship from the Council for Scientific and Industrial Research, Government of India; YOUNG SCIENTIST AWARD from Tamilnadu State Council for Science & Technology. Tamil Nadu, INDIA; Best Teacher award from Pondicherry University. She has more than 40 research publications and has guided 4 PhD Students who were awarded Ph.D. degrees. She has been invited as a Guest speaker/Resource person on several conferences/Seminars; as organised and conducted more than 30 Conferences and has participated in more than 100 seminars/Conferences/Workshops. She holds Life Membership of some of the important professional Bodies such as RMS, IIScAA, ACCS, ADMA etc.

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Practical Application of Mycorrhizoremediation in Phytoremediation of Heavy Metal Contaminated Soils

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ABSTRACT

Phytoremediation is a sustainable and inexpensive method of removing pollutants such as heavy metals from the environment using plants and is at the forefront of environmental biotechnology research. The remediation of heavy metal contamination is a challenging task as these elements are non-biodegradable and once entered into the soil they can persist for a long time. Traditional methods used for the removal of heavy metals from the environment are generally expensive and risky as they can potentially generate hazardous by-products. In comparison phytoremediation is a slower and more efficient process with the goal of either stabilizing the heavy metals or by removing them from the soil. Efficiency of removal can be further improved by mediation through arbuscular mycorrhizal (AM) fungal associations, which are an integral part of plant roots that enhance plant growth on severely disturbed sites including those contaminated with heavy metals. AM fungi act as a filtration barrier against transfer of heavy metals to plant shoots. They exist in most natural habitats and provide a range of important ecological functions, particularly in improving plant nutrition, stress resistance and tolerance, soil structure and fertility. AM fungi has been reported to be present on the roots of plants growing in heavy metal contaminated soils and play an important role in metal tolerance and accumulation. By colonizing the roots, the fungus increases plant growth by making soil essential elements like zinc and phosphorus more accessible. In recent studies, it has been found that AM fungi can play a role in the phytoremediation of heavy metal contaminated soil (mycorrhizoremediation). Mycorrhizoremediation uses plants as well as microorganisms to contain or clean up heavy metals. It has the added benefit of being a relatively low-cost natural solution to an environmental problem. In this study sunflower and corn plants grown in industrial heavy metal (Cd, Cu, Pb and Zn) contaminated filtercake soil amended with chelates (DTPA and EDTA) and imported AM fungi (mostly *Glomus* and Gigaspora species) were used in the greenhouse experiments. Chelates increase heavy metal bioavailability in soil and promote uptake by plants.The results of the study showed that heavy metal extraction by sunflower and corn in the soil spiked with chelates occured in the following order; Zn > Cu > Pb > Cd. For soil inoculated with imported AM fungi the order of metal extraction in sunflower was Cu > Zn > Pb > Cd and for the corn was Zn > Cu > Pb > Cd. It was found the bioavaliability of metals due to chelates reduced the root AM fungal colonization. Further, AM fungal colonized sunflower plants after four weeks and corn plants after six weeks showed more root AM fungal colonization without soil spiked with chelates. For both plants there is no observable trend relating the shoot and root weight ratio to either the amount of added chelates or imported AM fungi. It was generally concluded that the extraction of heavy metals by sunflower and corn depending on the metal bioavalibility in the soil spiked with chelates and AM fungi colonized plants.

Keywords: Phytoremediation, Mycorrhizoremediation, Mycorrhizae, Heavy metals

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Spread of HIV Infection and its Remedial Measure Using Drug Therapy - A Mathematical Analysis

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ABSTRACT

Mathematical study on the rate of spread of the Human Immunodeficiency Virus (HIV) and the drug treatment to reduce and cure the infection model is studied and analyzed computationally using spectral collocation method. The model explains briefly the mechanism of the infection and how it spreads in the blood cells and a suitable mathematical model is proposed to study the mechanism. For curing the disease, the study uses two different antiretroviral (ARV) drug therapy such as Reverse Transcriptase Inhibitor (RTI) and Protease Inhibitor (PI) that influences the HIV infection spread rate. Here, three different cases, such as, when there is no therapy; single therapy is administered and the combined therapy (both RTI and PI) are administered are considered and their effects on the rate of spread of HIV infection in the blood is analyzed. All these analysis are well supported from our computations and results that are presented in the form of tables and figures.

Keywords: HIV Infection; Combined ARV Drug Therapy, RTI, PI

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Grain Level Characterization of Widely Cultivating New Improved Rice (*Oryza sativa* L.) Varieties of Sri Lanka Using a Seed Key Developed through Chemical and Physical tests

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ABSTRACT

Rice is the staple food in Sri Lanka and country holds more than 60 new improved rice varieties developed by the Department of Agriculture, Sri Lanka. Identification of these rice varieties is essential to maintain the genetic purity of seeds as it is a predominant character of quality seeds. The quality of seeds is highly important for plant breeders, farmers and finally for the rice consumers. Typically, rice varieties are identified by plant morphological characters which enables the identification of the plant however not the grains. Further, to study the plant morphological characters needs to carry out field grow-out-tests which requires more area. Additionally, identification using plant morphological traits is time consuming. In comparison, the chemical tests are simple, rapid and reproducible. Internationally most of these chemical tests have been used for varietal identification of wheat, oat, barley and rice. However, there is no single study conducted in the country for varietal identification based on chemical tests to date. Therefore, present study aimed at identification of 15 new improved rice varieties of Sri Lanka namely At 307, At 308, At 311, At 362, Bg 300, Bg 352, Bg 358, Bg 360, Bg 366, Bg 379-2, Bg 403, Bg 450, Bg 94-1, Bw 272-6b and Bw 367 at grain level using chemical and physical tests. As chemical tests NaOH, KOH, ferrous sulphate, phenol and modified phenol tests were used. Grain size was studied as the physical test. Further, four replicates of 50 paddy seeds and five replicates of 10 paddy seeds for each rice variety were used as the sample size in chemical and physical tests respectively. Results showed that rice varieties can be categorized into 2 (light yellow and reddish brown), 3 (light yellow, light brown and reddish brown), 2 (brown streaks and dark brown streaks), 2 (brown and reddish brown) and 2 (dark brown and dark reddish brown) based on NaOH, KOH, ferrous sulphate, phenol and modified phenol tests respectively.

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According to grain size classification, rice varieties were grouped into 3 as short (< 8.0 mm), long (9.8-8.8 mm) and extra-long (≥ 9.9 mm) grains. The seed key developed using chemical and physical tests could only be identified At 362, At 311, Bw 272-6b and At 307 varieties at grain level and other varieties could be grouped to two groups. It is concluded that seed key developed using chemical and physical tests can be identified some rice varieties at grain level among the selected Sri Lankan rice varieties and identification of other varieties may be possible by combining other methods used in grain identification.

Keywords: New Improved Rice, Varietal Identification, Chemical Tests, Physical Tests

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Modeling COVID -19 Daily Infected Cases in the UK

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ABSTRACT

The UK has reported the 4th highest infected cases globally. The UK exceeds 8.4 million cases since 22nd January 2020 and still reporting a higher volume of daily infected cases. The future outbreak of the pandemic might be doubtful. The authorities should examine the future behavior of the outbreak and prepare to minimize the spread of the pandemic to ensure the sleek function of the country. Hence, the study has been designed to forecast the daily infected cases of COVID -19 within the UK to understand the future behavior of the outbreak. The daily confirmed cases of COVID-19 of the UK for the period of 22nd January 2020 to 17th October 2021 were obtained from the World Health Organization (WHO) database. The behavior of the outbreak was identified by Time series plots and Auto Correlation Function (ACF). Sama Circular Model (SCM) was selected to forecast the pandemic by considering the pattern of the outbreak. The fitted model was validated by applying the Anderson Darling test, ACF, and Ljung-Box Q (LBQ)-test. The forecasting ability of the models was assessed by both relative and absolute measurements and errors. They are; Mean Absolute Percentage Error (MAPE), Mean Square Error (MSE), and Mean Absolute Deviation (MAD). The results of the study revealed that the SCM is satisfied with all criteria and the performance of the model was extremely high. Measurements of errors were very low under the model fitting and verification process. It is well observed the repeating behavior of daily infected cases in every 3 days and 8 days. It is recommended to impose and monitor non-pharmaceutical interventions to minimize and control the outbreak of the COVID -19. Further, it is recommended to model the outbreaks of the pandemic in other European countries and identify the repeating behaviors.

Keywords: Daily Cases, Repeating Behavior, SCM, COVID-19

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Model Development for Damped and Forced Type of Oscillations in Time Series

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ABSTRACT

The motion which repeats after a regular interval of time is defined as periodic motion. The periodic motion in which there is existence of a restoring force and the body moves along the same path to and fro about a definite point called equilibrium position/mean position, is called oscillatory motion. The oscillatory motion could be either linear oscillation or circular oscillation. For examples, the oscillation of strings of musical instruments is linear oscillation whilst the oscillation of simple pendulum of a clock is circular oscillation. A wave is a correlated collection of oscillations. For example, in a wave traveling along a string, each point in the string oscillates back and forth in the transverse direction (perpendicular to the direction of the string); in sound waves, each air molecule oscillates back and forth in the longitudinal direction (the direction in which the sound is traveling). Therefore understanding oscillatory motions is the base of understanding waves. Oscillatory motions and wave like patterns are common in time series data as well. For examples, number of infected cases of a disease in epidemiology; species migration in ecology, human blood sugar or blood pressure levels in biology; harvest of crops in agriculture; behavior of consumer price index in economics; share returns in finance; number of arrivals to a cultural landscape in tourism management etc. follow regular or irregular wave like patterns. The Auto Regressive Integrated Moving Average (ARIMA), Seasonal Auto Regressive Integrated Moving Average (SARIMA), Circular Model (CM) and Sama Circular Model (SCM) were successful in modeling such series. The literature revealed that the daily infected cases of Covid 19 show irregular wave like patterns with; increasing amplitudes, decreasing amplitudes or both, but none of the existing time series forecasting techniques are capable in capturing them. Pattern of these series are somewhat similar to the pattern of Damped oscillation and Forced oscillation described in Physics. Hence the authors of the study intended to develop suitable forecasting techniques to model such time series and developed two new stochastic models named; Damped Circular Model (DCM) and Forced Circular Model (FCM). The development of the models were based on, Circular model, which was based on Simple harmonic motion; theory of Damped and Forced Oscillations and the Second order Differential Equations. It is recommended to test the DCM and FCM on real life data in the fields of epidemiology and others.

Keywords: Circular Model (CM), Damped Oscillation, Forced Oscillation

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Forecasting COVID -19 Daily Infected Cases in Ukraine

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ABSTRACT

Ukraine has reported the 6th highest European Union country grabbed by COVID -19. Ukraine exceeds 2.6 million cases since 22nd January 2020 and still reporting an increasing trend with repeating the behavior. Due to the prevailing pandemic situation in the country, the future outbreak is doubtful. Identifying the future behavior of the outbreak is very important to be proactive and minimize the spread of the pandemic. It will be very useful to ensure the economic and social stability of Ukraine. Hence, the study has been designed to model the daily infected cases of COVID -19 within Ukraine to understand the future behavior of the outbreak. The daily confirmed cases of COVID-19 of the country for the period of 22nd January 2020 to 19th October 2021 were obtained from the World Health Organization (WHO) database. The pattern of the outbreak was identified by Time series plots and Auto Correlation Function (ACF). Holt's Winters three-parameter additive and multiplicative models were selected by considering the pattern of the data set. The Anderson Darling test, ACF, and Ljung-Box Q (LBQ)-test were applied to test the model assumptions. The forecasting ability of the models was assessed by both relative and absolute measurements and errors. They are; Mean Absolute Percentage Error (MAPE), Mean Square Error (MSE), and Mean Absolute Deviation (MAD). The results of the study revealed that Holt's Winters three-parameter additive and multiplicative models with α (level) 0.99, γ (trend) 0.25, and δ (seasonal) 0.18 were satisfied with all criteria and the performance of the model was extremely high. Measurements of errors were very low under the model fitting and verification process. Holt's Winter's three-parameter additive and multiplicative models are suitable models to forecast the infected cases within Ukraine. It is identified the repeating behavior of daily infected cases in every 7 days. It is recommended to impose and monitor non-pharmaceutical interventions to minimize and control the outbreak of the COVID -19 in Ukraine. Further, it is recommended to model the same outbreak to capture other hidden repeating behaviors to defeat the pandemic.

Keywords: Daily Cases, Repeating Behavior, Holts Winter's, COVID-19

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