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Editorial: Special Issue on Applied Mathematical Sciences

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It gives me an immense pleasure to write this editorial article of the special issue on Applied Mathematical Sciences in Walailak Journal of Science and Technology.

An advance in mathematical sciences is concerned with research events for mathematical analysis and its applications to natural and social sciences as well as engineering. Many researchers have contributed their articles from different domains, spanning the gamut of nuclear reactor design to fluid dynamics. The special issue covered several topics from computational fluid dynamics, numerical analysis, etc. Moreover research and expository papers devoted to important mathematical results and topics of current interest in their areas.

It is true that applied mathematical sciences play an important role in describing, analyzing and designing new computational techniques in all areas of science, engineering and technology for solving linear and nonlinear problems. Moreover, an applied mathematical science has been a central feature of humanity's intellectual achievements over the past several centuries and also now. Its role in the physical sciences and engineering is well established and continues to aid in their development. Definition clearly states that "*applied mathematics problems are mathematical problems which importance is self-evident*" and other definition says that "*success in applied mathematics is a new elegant model that catches the phenomenon and novel clever methods to solve it*". The influence of computer technology, the budding significance of computer modeling, the mathematization of all sciences, the fading of traditional scientific boundaries, and the requirement of scientific planning all create the need both in education and abreast research developments. From literature review it is understood that, applied mathematics is a group of methods aimed for solution of problems in sciences, engineering, economics, or medicine. Furthermore, these methods are originated by famous scientists Newton, Euler, Lagrange, Gauss and others. Modern areas of applied mathematics include mathematical physics, mathematical biology, control theory, aero-space engineering, optimal planning, and mathematical finance, so on. There is a fuzzy boundary between applied mathematics and engineering and at the other side, between applied and pure mathematics. This is due to applied mathematics discovers novel problems which could become subjects of pure mathematics (like geodesics), or develop to become a new engineering discipline (like elasticity theory). Applied mathematics allows for several approaches to the problem, a choice of objectives, and variety of techniques.

Indeed, mathematics is also becoming increasingly important in social and life sciences with an extensive range of novel practical applications requiring sophisticated mathematical techniques and algorithms. Therefore, the field of applied mathematical sciences is undergoing remarkable growth and also the improved analysis, including the effectiveness and applicability, of existing methods and algorithms is of importance. The computational efficiency (e.g. the convergence, stability, accuracy, etc.) should be proved and illustrated by non-trivial numerical examples. Real time applications range from experimental design and data analysis in the physical and social sciences, medicine and engineering, to modeling and forecasting in business and government, to actuarial applications in the financial and insurance industries. Applied mathematics deals with the use of mathematical concepts and techniques in many areas of science and engineering. It is noteworthy to point out that, mathematics was initially employed with great success in the field of astronomy and mechanics. Moreover, it was developed into and applied to major tool of physics, other physical sciences, and engineering. It is now important in the biological, geological, and social sciences etc. With the coming of age of the computer, applied

mathematics has transcended its traditional style and now assumes an even greater importance and a new vitality.

It is pertinent to pin point out that, Mathematics, by its nature, is a broad and varied discipline, straddling virtually in all fields of science. There is no doubt at all that, the advent of modern digital computers has further broadened the importance and impact of mathematics. Furthermore, mathematics provides much of the language and quantitative underpinnings of the natural and social sciences, also mathematical scientists have been responsible for the development of many of the most commonly employed tools in business management as well as for laying the foundation for computational and computer science. In particular, an educational experience in applied mathematical sciences provides researches with sound knowledge in fundamentals of mathematics and the skills required to employ mathematics to real-world phenomena in the social sciences, natural sciences and engineering etc. It is essential that researcher must need strong fundamentals while allowing for building expertise in an application area through the emphasis tracks. It is necessary that researcher must learn new ideas in case of analytical reasoning and problem solving from other fields which includes physics, computational biology, economics, computer science and engineering, and engineering mechanics in order to incorporate effectively and efficiently. For instance, it is well known, that derivatives and integrals, ordinary and partial differential equations, and linear and non-linear algebraic equations are the basic / fundamental kinds of mathematical structures (types of mathematical models) which can be successfully applied to a broad range of environmental science subfields. In simple, mathematical sciences can select a concentration of applied mathematics, which focuses on the analytical and computational methods essential to solve several of today's real time problems. These techniques conventionally been employed in various diversified areas as chemistry, physics and so on. For instance, a physical scientist is much more concerned with the formulation of problems and the nature of solutions. In contrast, engineers are more concerned with the accuracy of approximations and the interpretation of results. Applied mathematics, by its very nature, has occupied a central position in this interplay and has remained a field of fascination and excitement for active minds. Study of applied mathematics requires expertise in many areas of mathematics and science, physical intuition and common sense, and collaboration skills. The career opportunities in mathematical sciences or in those areas of applied mathematics which center around the use of computers and are concerned with the problems of the social and management sciences. It is significant to point out that research in applied mathematical sciences must provide an outlet for topics of immediate interest because of the novelty of its treatment of an application or of mathematics being applied or lying close to real time applications.

This special issue includes a select group of nine research articles out of many submissions and broadly, the work compiled in this special issue addresses mainly four aspects of the theme: performance comparison of known methods, deriving / developing novel variants of existing techniques and corresponding algorithms, new ways of modelling problems in contemporary and niche areas while relating theories.

The first article is concerned with the unsteady flow of a Carreau fluid through inclined catheterized arteries having a balloon with time-variant overlapping stenosis by Khaled Saad Mekheimer, Faiza Salama and Mhamod Elkot.

In second article an investigation is carried out which deals the peristaltic flow of a Williamson fluid model in an asymmetric channel with different wave forms under the effects of partial slip by Safia Akram, Sohail Nadeem and Anwar Hussain.

In third article is about the present study on the problem of nonlinear equations arising in a convective porous fin with variable cross section has been investigated using a Collocation Method by Majid Shahbaei, Davood Domiri Ganji and Iman Rahimipetroudi.

In fourth article an analytical technique has been established to determine approximate periods of nonlinear *Duffing-harmonic* oscillator by Md. Alal Hosen.

Fifth article discusses about First Integral method applied to solve (1+1) dimensional dispersive long wave systems by Jafar Biazar and Mohamad Bagher Mehrlatifan.

Sixth article deals with employing an approximate analytical technique, namely, the Optimal Homotopy Asymptotic Method (OHAM), to investigate the analytical solution of the well-known Painlevé equation II by Fazle Mabood, Waqar Ahmad Khan, Ahmad Izani Md Ismail and Ishak Hashim.

In seventh article abundant travelling wave solutions of fifth order Caudrey-Dodd-Gibbon-Sawada-Kotera (CDGSK) equation are obtained in a uniform way by using the alternative (G'/G)-expansion method, wherein the generalized Riccati equation is used by Muhammad Shakeel and Syed Tauseef Mohyud-Din.

Eighth article deals with an extended, (G'/G)-expansion method with a computerized symbolic computation is used for constructing the exact travelling wave solutions for isothermal magnetostatic atmospheres equations arising in physics by Mohamed Tawfik Attia, Attala Elhanbaly and Mohamed Aly Abdou.

The last paper addresses about a nuclear reactor design and exponential growth problems by employing explicit third order Euler method which is consistent, stable, efficient, accurate, convergent order is three, wider region of absolute stability and easy to implement with lower computational cost by Sukumar Senthilkumar.

Finally, I would like to take this opportunity to warmly thank the efforts rendered by many (anonymous) reviewers, editorial board members, editorial team and editor editor-in-chief.

SUKUMAR SENTHILKUMAR received his B.Sc in Mathematics from Madras University in 1994, M.Sc and M.Phil in Mathematics from Bharathidasan University in 1996 and 1999, PGDCA and PGDCH from Bharathidasan University in 1996 and 1997, respectively and M.Phil in Computer Science & Engineering from Bharathiar University in 2000. He has a research doctoral degree in the field of Mathematics and Computer Applications from National Institute of Technology [An Institute of National Importance-formerly Regional Engineering College], Tiruchirappalli, Tamilnadu, India. He worked as a Post Doctoral Fellow at the School of Mathematical Sciences, Universiti Sains Malaysia [An Apex University] in Pulau Pinang, Malaysia. Also, he worked as a Post Doctoral Researcher at the Center for Advanced Image and Information Technology, School of Electronics and Information Engineering, Division of Computer Science and Engineering, Chon Buk National University, Jeonju, Chon Buk, South Korea. He was a lecturer/assistant professor in the Department of Computer Science at Asan Memorial College of Arts and Science, Chennai, Tamilnadu, India. At present, he is working as an Associate Professor in the School of Computing Science and Engineering at Vellore Institute of Technology-University, Vellore, Tamilnadu, India. He has published many scientific research papers in peer reviewed international journals. He is also an editor, associate editor, editorial board member, advisory board member, reviewer and referee for many scientific international journals. His current research interests include cellular neural networks, digital image processing, numerical analysis & methods, simulation & computing and other related areas including astrophysics and oceanography.