Editors
Hamido Fujita
Milan Tuba
Jun Sasaki

Recent Advances in Automatic Control, Modelling & Simulation

- *Proceedings of the 12th International Conference on System Science and Simulation in Engineering (ICOSSSE '13)*
- *Proceedings of the 2nd International Conference on Systems, Control, Power, Robotics (SCOPORO '13)*
- *Proceedings of the 2nd International Conference on Automatic Control, Soft Computing and Human-Machine Interaction (ASME '13)*

Morioka City, Iwate, Japan, April 23-25, 2013

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Plenary Lecture 1

Analytical Solutions in Travelling Wave Coordinate of Controlled Drug Release on Planar Structure

Professor Yongwimon Lenbury
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Abstract: Mathematical modeling and computation play an important role in the design of pharmaceutical products. The United States Food and Drug Administration Critical Path Initiative has recently identified model-based drug development, including drug and disease modeling, as an important goal (www.fda.gov/oc/initiatives/criticalpath). New discoveries and theories generated by model construction have been appearing in many prominent biologically related journals. In the formulation of pharmaceutical products, the use of controlled-release technology is becoming increasingly important. In 2003, Göran Frenning formulated and numerically investigated a mathematical model of the drug dissolution and release processes. The model can be expressed in terms of two coupled nonlinear partial differential equations. Later, Chontita and Lenbury (2012) explained how analytical solutions can be found for a system of reaction diffusion equations in the form of a travelling wave front using the travelling wave coordinate when the wave is assumed to be moving at constant speed. Here, we present certain travelling wave solutions of the model of controlled drug released, in a planar geometry, for different cases in which analytical solutions can be derived exactly.

Brief Biography of the Speaker: After Professor Yongwimon Lenbury obtained her Ph.D. in Mathematics from Vanderbilt University, USA, she returned to the Department of Mathematics, Faculty of Science, Mahidol University to teach, and conduct research in dynamical modeling of nonlinear systems in biology and medicine. She was appointed professor of Mathematics in 1996. Prof. Lenbury has been involved in research work in the field by Mathematical Modelling and Nonlinear Systems in Biology and Medicine. Her work involves dynamical modelling and analysis of nonlinear systems such as food chains coupled by parasitic infections, hormone secretion systems in the human body, and so on. Of particular interest are the pacemaker oscillations and rhythmogenesis in human mechanism which have been proposed as a way to differentiate sickness from health. For example, some of her works involves the construction and analysis of a model for insulin kinetics and the identification of oscillatory behavior subject to various feeding regimens. Her recent interest has been concentrated in the signal transduction system involving GPCR, a major drug target. She received an award from the National Research Council as the Outstanding Researcher in the field of Physical Science in the year 1998. Her continued achievements have resulted in her being granted the prestigious position of Senior Researcher of the Thailand Research Fund in Mathematics, 2000-2002 and a Fellow of the Royal Institute of Thailand. Collaborating with several researchers in various countries such as the United States, Germany, Italy, and New Zealand, Prof. Lenbury has been devoted to the promotion of research and education in the field of Mathematics in Thailand.

Plenary Lecture 2

Non-Monotonous Behaviour of Shear Viscosity - Empirical Modelling

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Abstract: Practically all hitherto used empirical models used for characterisation of shear viscosity of liquids describe only its monotonous course. However, the onset of new materials is accompanied by more complicated characteristics of their behaviour including non-monotonous course of shear viscosity. This feature reflects not only in an existence of one extreme point (maximum or minimum) but there can appear both extreme points; i.e. that shear viscosity initially exhibits shear thinning, after attaining a local minimum converts to shear thickening, and again after reaching a local maximum has a shear-thinning character. It is clear that for an empirical description of this complex behaviour a hitherto used number of parameters (four, five) in classical monotonous models (such as Cross or Carreau-Yasuda) are no longer tenable. If more parameters are applied, there should be given an emphasis on a relatively simple algebraic form of the proposed models, unambiguity of the involved parameters and their sound interpretation in the whole modelling. This contribution provides an overview of the existing non-monotonous models and proposes a new 10-parameter model including a demonstration of its flexibility using various experimental data.

Brief Biography of the Speaker: Petr Filip graduated from the Charles University in Prague, Faculty of Mathematics and Physics, Czech Republic in 1976. He completed his Ph.D. study at the Institute of Mathematics, Acad. Sci. Czech Rep., his Ph.D. Thesis was devoted to oscillatory solutions of partial differential equations. Since 1980 he has been with the Institute of Hydrodynamics, Acad. Sci. Czech Rep., Prague, for many years as a head of the Department of Chemical Engineering where he was interested in fluid mechanics, especially theory of jets and mixing. Later on he was appointed to the position of a scientific secretary (up to now), at present his sphere of interest is rheology (flow of non-Newtonian liquids). He is an author (co-author) of more than 100 contributions published in international journals and conference proceedings.

Plenary Lecture 3

Consistent Aggregation of Information in Intelligent Systems

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Abstract: In this plenary talk we give an overview of some of our contributions to the problem of information aggregation. The framework is provided by intelligent systems, which are human engineered systems that show intelligent behavior or features.
The need for fusing different types of information items arises naturally in diverse theoretical and practical problems. The process of combining several (numerical) values into a single representative one is called aggregation, and the function performing this process is called aggregation function.
Even if the information items can be of different types, it is possible to reinterpret them in a unique formal setting by means of profiles, which are extensions of fuzzy set membership functions. Then the original aggregation problem can be modeled by an appropriate profile aggregation. Based on this approach, in this talk we concentrate on aggregation functions as mappings that assign a single output in the closed unit interval to several inputs from the same interval.
The problem of consistent aggregation, as our starting point and guide in the talk, is formulated in a tabular form that is easy to understand, and to justify as a natural requirement. Its mathematical formulation leads to a general functional equation of several functions and several variables. Well-known aggregation classes can be interpreted in this framework, satisfying particular forms of the general equation.
The resulted aggregation functions can be interpreted either as logical connectives originated from many-valued logics, with typical examples of triangular norms and conorms, uninorms and nullnorms, or as averaging operators allowing a compensation effect such as the arithmetic mean, which play a key role in probability and other classical areas.
In the first part of this talk we give an overview of consistent aggregation functions. In particular, we reveal their fundamental properties and identify four main classes: conjunctive, disjunctive, internal, and mixed aggregation functions. In each class we identify and characterize prototypical subclasses with illustrative examples.
In the second part of the talk we sketch someimportant and interesting applications of consistent aggregations.

Brief Biography of the Speaker: János Fodor is full professor of mathematics at Óbuda University, Budapest, Hungary. He is Doctor of the Hungarian Academy of Sciences. He has been pursuing research in mathematical foundations of fuzzy logic, computational intelligence, preference modelling, inference, and uncertainty management since 1987. He is co-author of two monographs and over 250 papers. These works received more than 4000 citations.
He acts as president of the Hungarian Fuzzy Association, chair of the IEEE Hungary Section Chapter of Computational Intelligence Society, and coordinator of the EUROFUSE EURO Working Group on Fuzzy Sets.
He is elected as Fellow of IFSA in 2013. He is Doctor Honoris Causa of the ”Politehnica” University of Timisoara (Romania).
He has presented papers at more than 150 international and domestic conferences. He has delivered numerous plenary and invited talks, and acted as General Chair, Program Committee Chair or Member at diverse scientific international conferences.
He is Editor-in-Chief of Acta Polytechnica Hungarica, Area Editor of Fuzzy Sets and Systems, member of the Editorial Advisory Board of the International Journal of Advanced Intelligence Paradigms, editor of the European Journal of Operational Research, Computing and Informatics, Acta Mechanica Slovaca, ROMAI Journal on Computer Science, Transactions on Automatic Control and Computer Science. He is Co-Editor-in-Chief of Springer Book Series entitled Topics in Intelligent Engineering and Informatics. He has been a coordinator of several research projects. He has been Invited Professor at various universities in Belgium, Italy, France and Spain.