Mathematical Methods in Science and Engineering

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Proceedings of the 1st International Conference on Mathematical Methods & Computational Techniques in Science & Engineering (MMCTSE 2014)

Athens, Greece, November 28-30, 2014

Edited by

Nikos Mastorakis
Peter Revesz
Panos M. Pardalos
Cornelia Aida Bulucea
Atsushi Fukasawa

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Plenary Lecture 1

Cubic Spline Interpolation by Solving a Single Recurrence Equation instead of a Triangular Matrix

Professor Peter Revesz
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Abstract: The cubic spline interpolation method is probably the most widely-used polynomial interpolation method for functions of one variable. However, the cubic spline method requires solving a triangular matrix-vector equation with an O(n) computational time complexity where n is the number of data measurements. Even an O(n) time complexity may be too much in some time-ciritical applications, such as continuously estimating and updating the flight paths of moving objects. This paper shows that under certain boundary conditions the triangular matrix solving step of the cubic spline method could be entirely eliminated and instead the coefficients of the unknown cubic polynomials can be found by solving a single recurrence equation in much faster time.

Brief Biography of the Speaker: Peter Revesz holds a Ph.D. degree in Computer Science from Brown University. He was a postdoctoral fellow at the University of Toronto before joining the University of Nebraska-Lincoln, where he is a professor in the Department of Computer Science and Engineering. His current research interests are bioinformatics, geoinformatics, databases and data mining. He is the author of several books, including the textbook Introduction to Databases: From Biological to Spatio-Temporal (Springer, 2010). He held visiting appointments at the IBM T.J. Watson Research Center, INRIA, the University of Hasselt, the Max Planck Institute for Computer Science, the University of Athens, and the U.S. Department of State. He is a recipient of a National Science Foundation CAREER award, and a J. William Fulbright, an Alexander von Humboldt, and a Jefferson Science Fellowship.

Plenary Lecture 2

Mathematical Models for Fostering the Sustainable Energy Conversion in Electric Power Systems

Professor Cornelia Aida Bulucea
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Abstract: To address meaningfully many of the problems facing electric power systems, conditions for the performance of sustainable electric systems must be formulated. Correspondingly, mathematical models can help understand the efficiencies of electrical systems and guide improvement efforts. Costs should reflect value, which is doubtless associated with sustainability aspects, and the benefits of using mathematical models to improve the sustainability of systems which convert electric energy are fostered.
In line with this idea, modelling the three-phase electrical transformer could attempt to optimize the efficiency of energy use within the power transformer operation. Hence, the structural diagram method applied to three-phase electric transformers is illustrating the efficiency of energy use within the power transformer operation, by highlighting the interactions and the feedback loops among the different variables (electric currents and magnetic fluxes) which describe the power transformer operation.
Following the notion of sustainable electrically driven systems, mathematical patterns illustrate energy conversion processes during the operation of electric railway vehicles with traction synchronous and induction motors, highlighting the chain of interactions within the main electric equipment. In order to support transport systems' sustainability the operation of electric railway vehicles has been addressed, on electrically driven railway systems supplied from a d.c. or an a.c. contact line. This presentation supports the findings that electric traction drive systems using synchronous motors fed by current inverters, and induction motors fed by variable voltage variable frequency (VVVF) inverters enhance the sustainable operation of electric railway trains.

Brief Biography of the Speaker: Cornelia Aida Bulucea is currently an Associate Professor in Electrotechnics, Electrical Machines and Environmental Electric Equipment in the Faculty of Electrical Engineering, University of Craiova, Romania. She is graduate from the Faculty of Electrical Engineering Craiova and she received the Ph.D degree from Bucharest Polytechnic Institute. In Publishing House she is author of four books in electrical engineering area. Research work is focused on improved solutions for electrical networks on basis of new electric equipment, and environmental impact assessment of electric transportation systems. She has extensive experience in both experimental and theoretical research work, certified by over 70

journal and conference research papers and 15 research projects from industry. Due to WSEAS recognition as huge scientific Forum she participated over time in nineteen WSEAS International Conferences, presenting papers and chairing sessions. She was Plenary Speaker in the 13th International Conference on Electric Power Systems, High Voltages, Electric Machines (POWER'13), Chania, Crete Island, Greece, August 27-29, 2013, in the 5th IASME/WSEAS International Conference on ENERGY&ENVIRONMENT (EE'10), held by the University of Cambridge, UK, February 23-25, 2010, in the 4th IASME/WSEAS International Conference on ENERGY&ENVIRONMENT (EE'09),), held by the University of Cambridge, Cambridge UK, February 24-26, 2009, in the 8th WSEAS International Conference on POWER SYSTEMS (PS'08), held by the University of Cantabria, Santander, Spain, September 23-25, 2008. She is very proud by her over 30 papers published in the WSEAS Conferences Books and in the WSEAS TRANSACTIONS ON ENVIRONMENT AND DEVELOPMENT, WSEAS TRANSACTIONS ON POWER SYSTEMS, WSEAS TRANSACTIONS ON CIRCUITS AND SYSTEMS and WSEAS TRANSACTIONS ON ADVANCES IN ENGINEERING EDUCATION.

Plenary Lecture 3

Synchronization of Neural Systems and Sensing of Acoustic Events in the Time - Space Domain

Professor Atsushi Fukasawa
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Abstract: Synchronization is an essential condition to organize large systems for computation, control, and telecommunication. Synchronization provides the system with stability and reliability. This condition should be applied to neural systems corresponding to the above functions. This lecture focuses on the study of neural systems operating under synchronous condition.
He will first present electro-physical modeling of an excitatory neuron. This model is given as the common structure of excitatory cells of paramecium (unicellular organism), neuron, and active semiconductor device. The commonality of these elements gives a unified structure with three zones in electrolyte or solid state semiconductor.
He will then present the principle of systematization of synchronous neural systems. This system was composed of recurrent connection of neurons. The system was applied for sensing of acoustic events in time - space domain of 2D plane and 3D space.

Brief Biography of the Speaker: Atsushi Fukasawa received the Master of Arts degree in Electrical communication and the Ph.D. degree from Waseda University in 1967 and 1983. He joined Graduate School of Science and Technology, Chiba University as a professor in 1997. He received the Award of the Agency of Science and Technology, Japan in 1982, and Ohm (publisher) Prize in 1994. He received Telecommunication System Technology Prize from the Foundation of Telecommunication Association, Japan in 2004. He is a senior member of the IEEE.

Plenary Lecture 4

Simulation and Design of a Lactose to Ethanol Conversion Unit in Cyprus

Professor Vassilis Gekas
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Abstract: Whey is produced as a byproduct following the halloumi cheese manufacturing process. Conversion of lactose, contained into the whey, to bioethanol would have a twofold benefit; (i) at getting rid of an environmental pollution problem andalso (ii) producing a biofuel thus contributing to the renewable energy balance of Cyprus. SuperPro Designer®, a simulation software, was used to run the model simulations because it contains a set of unit procedures that can be customized to the specific modeling needs throughout the lactose-to-ethanol conversion processes. This paper will attempt to first discuss quantitative and qualitative data of lactose production from whey, followed by the application of ethanol-plant simulation models that will be applied in order to convert lactose into biofuel. Finally, an example of an economic analysis generated by SuperPro® Designer will be presented assessing the financial feasibility of the proposed operation. The optimal conditions which such a unit can operate are also demonstrated in an attempt in increase the efficiency and efficacy of the proposed operation.

Brief Biography of the Speaker: VG was born in 1948 in Larissa of Greece, and graduated from the School of Chemical Engineering at the National Technical University of Athens (NTUA) in 1971. He fulfilled his military obligations 1971-1973 in the Greek army and then he worked in the Greek Industry for ten years. .He has specialized in the area of Food Engineering at the University of Lund in Sweden . obtaining his Master Thesis (1986) in “Lactose Hydrolysis towards a mixture of glucose and galactose” and his Ph D thesis (1987) in “Mass Transfer Studies in Ultrafiltration and in Bioreactors”. He did a postdoctoral sejour at the Paul Sabatier University of Toulouse, France, in the academic year 1990/1991, He became Docent (Assistant/Associate) Professor in Sweden in the year 1992. On 23d April 1997, he was elected at the rank of the Professor in the subject of Transport Phenomena at the Department of Environmental Engineering in the Technical University of Crete working there in the period 1998-2010. In the year 2010 he became a Professor at the Department of Agriculture, Biotechnology and Food Science and Technology of the Cyprus University of Technology at the rank of Professor and at the subject of Food Technology and Engineering. His research interests focus on the unit operations concerning the recovery of bioactive substances from aromatic herbs. According to the Web of Science his articles in peer review journal are 69 with a citation index, excluding self-references, 1619 and an h-index of 23. He is also the author of books in DEnglish and Greek.

Plenary Lecture 5

The Engine Power and the Exhaust Gas Emissions on an Outboard Engine

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Abstract: Outboard engine is a propulsion system for small boats to speedboats. It's consisted of a self contained unit that includes the engine, a gearbox and a propeller. It is called outboard because its entire structure remains on the boat exterior. The primary difference of an outboard engine in operation to other small engines is the inclusion of a driveshaft and propeller and cooling system which relies on water rather than air. Regarding on engine burning times, it is called two or four stroke engine. Each of these two types of engine have their own advantages and disadvantages. However, the most popular type of engine is the four stroke one due to its technological development. Particularly, the propulsion system of the four stroke engine has been designed to be placed on the vessels' transom and it is consisted of a self contained unit that includes the engine, a gearbox and a propeller. In addition to movement outboard engines provide steering control of the boat, as they are designed to rotate on their mounting material and thus control the direction of thrust. The aim of this work, it was built a construction that allows the function of an outboard engine in conditions similar to the factual. In order to measure the performance of the engine power, a prototype measurement procedure was developed. According to this procedure the measurement of the force is made by a direct connection between the engine's rpm and applied load. During the measurements operating characteristics of the engine, as well as the exhaust gases, were recorded. For the measurement of the emitted pollutants, a laboratory protocol and measurement standards defined by 40 CFR 1045 were used.

Brief Biography of the Speaker: Dr Charalampos Arapatsakos is a Greek citizen, who has been born in Athens. He has studied Mechanical Engineering and PhD. He is Professor on Democritus University of Thrace in Greece. Prof C. Arapatsakos has participated in many research programs about renewable sources of energy, gas emissions and antipollution technology. His research domains are mainly on biofuels and their use in internal combustion engines, the power variation from the use of biofuels, the gas emissions, mechanical damages, internal combustion engines, antipollution technology, renewable sources of energy, gas emissions, vehicle design, elements of machines, resistance of materials, technical mechanics, heat transmission.