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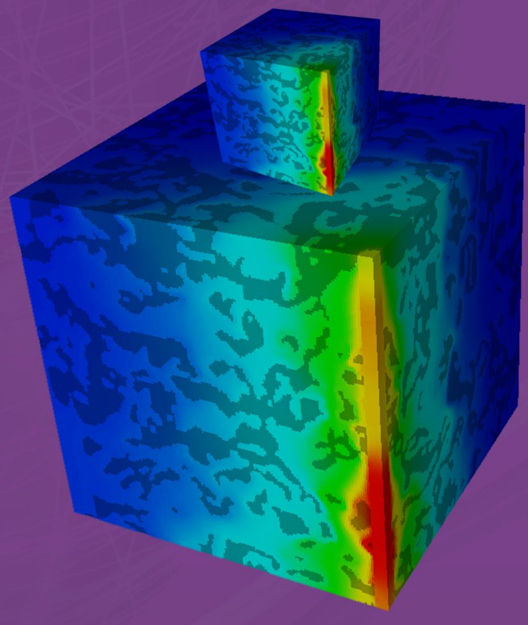

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Plenary Lecture 1

Shock Reflection Problems and Gas Dynamics Equations

Assistant Professor Katarina Jegdic
Computer and Mathematical Sciences
University of Houston – Downtown
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Abstract: We present mathematical analysis of shock reflection phenomenon using two-dimensional systems of conservation laws. Depending on the initial data, various types of shock reflection are possible, such as regular reflection (either supersonic or transonic) or Mach. We present proof of existence of regular reflection for the system of isentropic gas dynamics equations. The main idea in our approach is to rewrite the system using the self-similar coordinates. This leads to a free boundary problem for the subsonic state and the reflected shock. Existence of a solution is proved using the Holder estimates for the second order elliptic equations and various fixed point arguments. This work is joint with Barbara Lee Keyfitz (Ohio State University) and Suncica Canic (University of Houston).

Brief Biography of the Speaker:
Katarina Jegdic received B. Sc. degree in Mathematics from the University of Novi Sad, Serbia, in 1997. She obtained M.S. degree and Ph.D. degree in Mathematics from the University of Illinois at Urbana-Champaign, USA, in 2000 and 2004, respectively, after which she held a postdoctoral position at the University of Houston, USA. She is an assistant professor at the University of Houston - Downtown since 2006. Her research interests are in mathematical and numerical analysis of systems of conservation laws with applications to aerodynamics.

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Plenary Lecture 2

Language for Exact Description of Systems with Complex Control

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Abstract: To have a language for an exact description of systems is an advantage not only for a communication among people (systems designers, investigators, reviewers, implementers, users etc.) but also among an investigator and computer (for modeling, tests of completeness and/or consistency of the description etc.). The start point how to realize that way consisted in some process-oriented simulation languages designed and implemented in the 60-ies of the last century. Note that the process orientation covers an offer to use so called quasi-parallel sequencing (further QPS) that permits a separate formulation of “lives” of system elements, that mutually switch in the common time flow. Nevertheless, beside the limits of each of those languages (implying that descriptions of some systems in a given language were either very difficult or even impossible), another difficulty rose during the development of our civilization: the inner control and relating communication in the systems became more and more complex and sometimes even rather contradictory (in the systems influenced by antagonistic and/or mutually competing entities) decisions rise and are implemented inside the systems.
The first obstacle (limitation) was surmounted by advent of the object-oriented programming (classes, subclasses and procedures/methods/functions), but, unfortunately, soon after the spread of that programming method further from its original simulation stimulus incorporated in Simula, QPS disappeared from may be every object-oriented programming language designed since 1980, although that sort of sequencing existed even in some simulation languages designed before 1960.
The second obstacle can be illustrated as follows: when one starts to describe a system he needs to prepare and order general notions used then by the description, but when one exists as a component in the system (a human or a computer) and influences it he needs to express something similar – namely general notions semantically ordered – and than to use them. The antagonistic views practiced by influencing components show that may express general notions mutually in a different way but also differently from the way in that they were considered by the author of the description of the system, i.e. by a person existing outside the system. More exactly, such an author, describing the system, must express not only the contents of the general notions how he recognizes them, but also that of notions how the inner components of the described system consider them. Moreover, he has to separate different interpretations of the notions, although they carry the same names and often pay role in a common way.
The obstacles may be surmounted very well by using programming languages that are not only object-oriented and, naturally, process-oriented (permitting QPS) but permit local classes, too. The number of such languages is very small and, unfortunately, with the exception of the above mentioned “old” Simula, they do not allow QPS. The users of some of them (like Java) offer subrogating QPS with help of threads, i.e. by something that does not concern the described system but only its computer model. It should be respected that the suitable language should strictly separate between what should exist in the described systems and what in its computer model.
The presentation will contain some existing applications in transport, machine production, health care and computer systems.

Brief Biography of the Speaker:
Eugene Kindler was born in 1935, studied mathematics at Charles University in Prague, (Czechoslovakia) and then computer science at the Research Institute of Mathematical Machines in Prague. He is the author of the first Czechoslovak ALGOL 60 compiler and the first Czechoslovak simulation language and compiler (COSMO, Compartmental System Modeling). Charles University granted him PhDr in logic and RNDr (Rerum Naturalium Doctor) in the theory of programming, Czechoslovak Academy of Science granted him CSc (Candidate of Sciences) in mathematics and physics. During 1958-1966 he worked with the Research Institute of Mathematical Machines, then with the Institute of Biophysics of the Faculty of General Medicine of Charles University (until 1973) and then with the Faculty of Mathematics and Physics of the same University (until 2006). In parallel, he engaged as professor of applied mathematics at a new University of Ostrava (Czech Republic) and was guest professor at the universities of Italian Pisa, American Morgantown and French Clermont-Ferrand and Lorient. Since 2006 he has been pensioned,

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collaborating with the same Ostrava University as external specialist in various research projects, in doctoral studies and with a rather new Faculty of art.
Beside his official work in computer science, he applied exact techniques (applied in programming language analysis) to formulate the rhythmical laws of music in free rhythm and is a director and soloist of singing group Musica Poetica specialized to the chant originated during the first millennium A.D. in Europe and certain Near East Asian countries.

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Plenary Lecture 3

Stochastic Delay Lotka-Volterra System to Interacting Population Dynamics

Professor Andre A. Keller
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Abstract: This presentation introduces to the modeling process and reviews the essential features of the well-known Lotka-Volterra multispecies system in ecological modelling. The interacting population dynamics may be competitive or cooperative in the noisy environment of real world situations. In this stochastic context, the conditions for positive non exploding solutions are given. The computations have been carried out by using the software Wolfram Mathematica ® 8.

Brief Biography of the Speaker:
Andre A. Keller (Prof.) is at present an associated researcher in mathematical economics at CLERSE a research unit UMR8019 of the French Centre National de la Recherche Scientifique (CNRS) by the Universite de Lille 1, Sciences et Technologies. He is also participating to the group ‘Dynamique et Complexite’ which is supported by the Federation de Physique et Interfaces. He received a PhD in Economics (Operations Research) in 1977 from the Universite de Paris Pantheon-Sorbonne. He is a WSEAS Member since 2010 and a Rewiever for the journals Ecological Modelling (Elsevier) and WSEAS Transactions on Information Science and Applications.
He taught applied mathematics (optimization techniques) and econometric modelling, microeconomics , theory of games and dynamic macroeconomic analysis. His experience centers are on building and analyzing large scale macro-economic models, as well as forecasting. His research interest has concentrated on: high frequency time-series modeling with application to the foreign exchange market, on discrete mathematics (graph theory), stochastic differential games and tournaments, circuit analysis, optimal control under uncertainties. His publications consist in writing articles, books and book chapters. The book chapters are e.g. on semi-reduced forms (Martinus Nijhoff, 1984), econometrics of technical change (Springer and IISA, 1989), advanced time-series analysis (Woodhead Faulkner, 1989), stochastic differential games (Nova Science, 2009), optimal fuzzy control (InTech, 2009). One book is on time-delay systems (LAP, 2010). One another book is on nonconvex optimization techniques (WSEAS Press, forthcoming 2011).

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