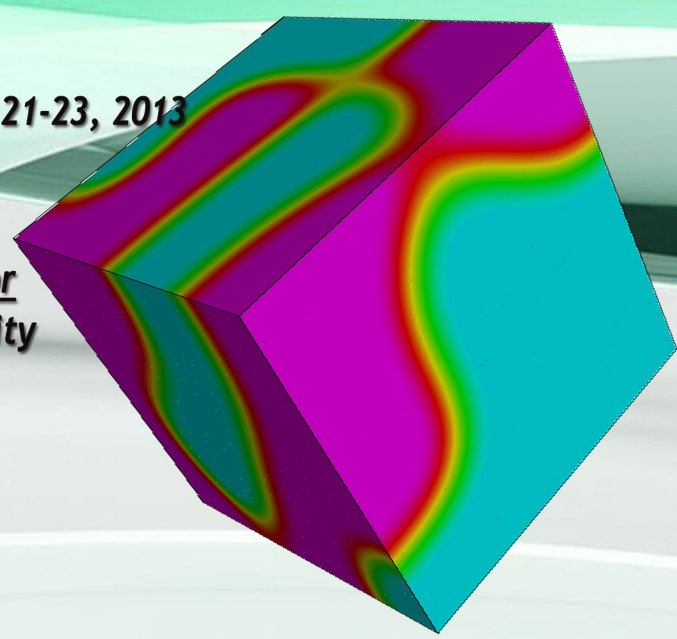
Editor
Andreas Kanarachos

Recent Advances in Mathematical Methods, Intelligent Systems & Materials

- *Proceedings of the 15th International Conference on Mathematical Methods, Computational Techniques and Intelligent Systems (MAMECTIS '13)*
- *Proceedings of the 6th International Conference on Materials Science (MATERIALS '13)*

Lemesos, Cyprus, March 21-23, 2013



Scientific Sponsor
Frederick University

Mathematics and Computers in Science and Engineering Series | 9

Recent Advances in Mathematical Methods, Intelligent Systems & Materials

RECENT ADVANCES in MATHEMATICAL METHODS, INTELLIGENT SYSTEMS and MATERIALS

Proceedings of the 15th International Conference on Mathematical Methods, Computational Techniques and Intelligent Systems (MAMECTIS '13)

Proceedings of the 6th International Conference on Materials Science (MATERIALS '13)

Lemesos, Cyprus
March 21-23, 2013

Scientific Sponsor:

Frederick University, Cyprus

Mathematics and Computers in Science and Engineering Series | 9

ISSN: 2227-4588
ISBN: 978-1-61804-168-5

RECENT ADVANCES in MATHEMATICAL METHODS, INTELLIGENT SYSTEMS and MATERIALS

Proceedings of the 15th International Conference on Mathematical Methods, Computational Techniques and Intelligent Systems (MAMECTIS '13)

Proceedings of the 6th International Conference on Materials Science (MATERIALS '13)

Lemesos, Cyprus
March 21-23, 2013

Published by WSEAS Press
www.wseas.org

All papers of the present volume were peer reviewed by no less that two independent reviewers. Acceptance was granted when both reviewers' recommendations were positive.
See also: http://www.worldses.org/review/index.html

ISSN: 2227-4588
ISBN: 978-1-61804-168-5

RECENT ADVANCES in MATHEMATICAL METHODS, INTELLIGENT SYSTEMS and MATERIALS

Proceedings of the 15th International Conference on Mathematical Methods, Computational Techniques and Intelligent Systems (MAMECTIS '13)

Proceedings of the 6th International Conference on Materials Science (MATERIALS '13)

Lemesos, Cyprus
March 21-23, 2013

Preface

This year the 15th International Conference on Mathematical Methods, Computational Techniques and Intelligent Systems (MAMECTIS '13) and the 6th International Conference on Materials Science (MATERIALS '13) were held in Lemesos, Cyprus, March 21-23, 2013. The conferences provided a platform to discuss new intelligent systems, new mathematical methods, new computational techniques or applications of known mathematical methods and computational techniques, molecular electronics, nanotubes and nanowires, chemical and biological sensors, semiconductor processing, management of materials etc with participants from all over the world, both from academia and from industry.

Their success is reflected in the papers received, with participants coming from several countries, allowing a real multinational multicultural exchange of experiences and ideas.

The accepted papers of these conferences are published in this Book that will be sent to international indexes. They will be also available in the E-Library of the WSEAS. Extended versions of the best papers will be promoted to many Journals for further evaluation.

Conferences such as these can only succeed as a team effort, so the Editors want to thank the International Scientific Committee and the Reviewers for their excellent work in reviewing the papers as well as their invaluable input and advice.

The Editors

Table of Contents

Plenary Lecture 1

Amplitude Equations for the Analysis of Stability of Fluid Flows

Professor Andrei Kolyshkin
Department of Engineering Mathematics
Riga Technical University
LATVIA
E-mail: andrejs.koliskins@rbs.lv

Abstract: Linear theory of hydrodynamic stability is used in practice in order to determine conditions where a particular base flow becomes unstable. Linear stability analysis provides a marginal stability curve which separates regions of linear stability and instability in the parameter space. In addition, critical value of the parameter S (where S is the critical Reynolds number for viscous flows or critical bed-friction number for shallow flows) can be obtained numerically. However, the linear stability theory cannot predict what happens with the most unstable mode when the base flow becomes unstable. Weakly nonlinear theories (based on the method of multiple scales) are used in such cases in order to analyze the development of instability above the threshold.
In the present talk we use weakly nonlinear theory to derive amplitude evolution equations for the most unstable mode. It is shown that evolution equations are obtained using the Fredholm's alternative. Two main approaches are used in the talk to illustrate the theory: (a) weakly nonlinear analysis based on a parallel flow assumption and (b) weakly nonlinear analysis based on the assumption that the base flow is slightly changing downstream. In case (a) the base flow is fixed at a particular station downstream (thus, the base flow is a function of one transverse coordinate) and weakly nonlinear expansion is constructed in the neighbourhood of the critical point where the parameter S is slightly above the threshold. Examples presented in the talk include single-phase and two-pahse shallow flows and transient flows in pipes. It is shown that in all the above mentioned cases the amplitude evolution equation is the complex Ginzburg-Landau (GL) equation. The coefficeints of the GL equation are expressed in terms of integrals containing characteristics of the linear stability problems. In case (b) the small parameter is the ratio of the length scale of the unstable mode and the length scale of the evolution of the base flow. First-order evolution equation is obtained in the case of single-phase and two-phase shallow flows where the base flow is slightly changing downstream. Numerical values of the coefficients of evolution equations can be used in order to describe possible scenarios of the development of instability. For example, the sign of the real part of the Landau constant in the GL equation can be used to describe whether a finite amplitude saturation of the most unstable mode will take place. Numerical examples are discussed in detail.

Brief Biography of the Speaker: Andrei Kolyshkin received his undergraduate degree in Applied Mathematics in 1976 at the Riga Technical University. In 1981 he received a Ph.D in differential equations and mathematical physics at the University of St. Petersburg (Russia). Andrei Kolyshkin is currently a full professor at the Department of Engineering Mathematics at the Riga Technical University. His current research interests include investigation of stability problems in fluid mechanics with applications to open- channel flows, transient flows in hydraulic systems and mathematical models for eddy current testing. He is the co-author of three monographs published by Academic Press and CRM. Andrei Kolyshkin has participated in more than 40 international conferences and has published more than 70 papers in refereed journals since 1980. As a visiting professor and visiting researcher he spent a few years at the University of Ottawa and Hong Kong University of Science and Technology.

Plenary Lecture 2

Research on Neural Systems in Brain – Knowledge on Events in Physical Measures, Time, Space, and Motion

Associate Professor Yumi Takizawa
Department of Statistical Modeling
Institute of Statistical Mathematics
Japan
E-mail: takizawa@ism.ac.jp

Abstract: She will present topics of research on neural systems in brain. Neural systems have variety of capabilities of sensing and responses for variety of events. She focused the study to know the principle of operation achieved by the nature. She has been most interested in to recognize events in the physical measures, the time, the point in space, motions and so on. She has reached to the fact that these functions are provided by synchronous neural systems to have time in common among neurons. This scheme has been proved by solving electro-physical dynamics. She is now trying to establish the basic capabilities of communication, control, and computation schemes operating in actual biological systems.

Brief Biography of the Speaker: Yumi Takizawa received the B.S. degree in Physics from Shinshu University in 1984, and the Ph.D. degree from the University of Tokyo in 1994. She was a research leader in communication system Lab., OKI Electric since 1984. She joined the Institute of Statistical Mathematics (ISM) as an associate professor in 1995. She received the Prize on Telecommunication System Technology from the Foundation of Telecommunication Association, Japan in 2004.
She has been engaged in neural systems in brain based on electro-physical and biological studies at the University of Virginia, USA and the ISM, Japan. She has been awarded for the Best Paper on NEUROLOGY'12.