



**Editors: Alexander Zemliak, Nikos Mastorakis**



***Recent Advances in  
Fluid Mechanics,  
Heat & Mass Transfer  
and Biology***

**8<sup>th</sup> WSEAS International Conference on  
Fluid Mechanics (FM '11)**

**8<sup>th</sup> WSEAS International Conference on  
Heat and Mass Transfer (HMT '11)**

**8<sup>th</sup> WSEAS International Conference on  
Mathematical Biology and Ecology (MABE '11)**

**Puerto Morelos, Mexico, January 29-31, 2011**

**ISSN: 1792-7757**

**ISSN: 1792-7773**

**ISSN: 1792-7730**

**ISBN: 978-960-474-268-4**

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Published by WSEAS Press

[www.wseas.org](http://www.wseas.org)

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All papers of the present volume were peer reviewed by two independent reviewers. Acceptance was granted when both reviewers' recommendations were positive.

See also: <http://www.worldses.org/review/index.html>

ISSN: 1792-7757

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**Preface**

This year the 8th WSEAS International Conference on FLUID MECHANICS (FM '11), the 8th WSEAS International Conference on HEAT and MASS TRANSFER (HMT '11) and the 8th WSEAS International Conference on MATHEMATICAL BIOLOGY and ECOLOGY (MABE '11) were held in Puerto Morelos, Mexico, January 29-31, 2011. The conferences remain faithful to their original idea of providing a platform to discuss mathematical modeling in fluid mechanics, simulation in fluid mechanics, hydrodynamics, plasma science, hydrology, thermal engineering, continuum mechanics, heat storage, climatology, solar energy, biophysics, genetics, molecular dynamics, quantum chemistry, photobiology, signal transduction, environmental systems, evolution, medical imaging, nuclear biology and medicine, speech synthesis 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 indexed by ISI. Please, check it: [www.worldses.org/indexes](http://www.worldses.org/indexes) as well as in the CD-ROM Proceedings. They will be also available in the E-Library of the WSEAS. The best papers will be also promoted in 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

<b>Plenary Lecture 1: Discussion of the Problem on Designing the Global Database for Different Kinds of Quenchants</b>	11
<i>Nikolai Kobasko</i>	
<b>On Order of Convergence for One Regularizing Method</b>	13
<i>Sharif E. Guseynov, Janis S. Rimshans, Jevgenijs Kaupuzs</i>	
<b>Model based UAV Autopilot Tuning</b>	18
<i>Tine Tomazic, Drago Matko</i>	
<b>Brief Notes on Vortex Identification</b>	23
<i>Vaclav Kolar</i>	
<b>Numerical Model to Characterize the Thermal Comfort in New Eco-Districts: Methodology and Validation through the Canyon Street Case</b>	29
<i>Khaled Athamena, Jean Francois Sini, Julien Guilhot, Jerome Vinet, Maeva Sabre, Jean-Michel Rosant</i>	
<b>Improved Mercury Removal from Water by Activated Ceramic: Sorption Isotherm</b>	38
<i>Jatindra N. Bhakta, Md. Salim, Yukihiro Munekage</i>	
<b>Environmental Based Study on Seasonal Variations of Mood and Behavior</b>	45
<i>Sadaf Sajjad</i>	
<b>Modeling of Surface Structure Formation after Laser Irradiation</b>	49
<i>J. Kaupuzs, Sh. E. Guseynov, J. Rimshans, A. Medvid</i>	
<b>Analysis with Boundary Elements of Heat Conductivity in Steady State Regime</b>	57
<i>Ioan Sarbu</i>	
<b>Correlation for Boiling Heat Transfer on Porous Surfaces Tubes</b>	63
<i>Emilian Stefan Valea, Ioan Sarbu</i>	
<b>Nodal Analysis Models of Water Supply Networks</b>	68
<i>Ioan Sarbu, Emilian Stefan Valea</i>	
<b>Convective Instabilities in Superposed Porous and Fluid Layers in the Presence of Coriolis Forces</b>	74
<i>Abdullah A. Abdullah, Hanadi M. Banjar</i>	
<b>An Explanation of Possible Damascus Steel Manufacturing Based on Duration of Transient Nucleate Boiling Process</b>	81
<i>Nikolai Kobasko</i>	
<b>Response of a Generalized Langevin System to a Multiplicative Trichotomous Noise</b>	87
<i>Erkki Soika, Romi Mankin, Jaanis Priimets</i>	

<b>The Composition of the Domestic Waste in Timisoara</b> <i>Iulia Para, Daniela Stanciu</i>	94
<b>The Effect of Limiting Resources in Aging Populations</b> <i>Chrysline Margus Pinol, Ronald Banzon</i>	100
<b>Experimental Analysis of the Behavior of the Droplets of High Viscous Fluids Impacting on a Flat Heated Surface</b> <i>A. Amoresano, V. Niola, F. Langella</i>	105
<b>Preliminary Study of Carbon Storage Rate in Mangrove Soils in Atasta Peninsula, Campeche, Mexico</b> <i>J. Guerra Santos, R. M. Ceron Breton, J. G. Ceron Breton, R. C. Sanchez Junco, D. L. Damian Hernandez, M. Muriel, A. Alderete Chavez</i>	111
<b>Discussion of the Problem on Designing the Global Database for Different Kinds of Quenchants</b> <i>Nikolai Kobasko</i>	117
<b>Numerical Model to Characterize the Thermal Comfort in New Eco-Districts: Methodology and Validation through the Canyon Street Case</b> <i>Khaled Athamena, Jean Francois Sini, Julien Guilhot, Jerome Vinet, Maeva Sabre, Jean-Michel Rosant</i>	126
<b>Fluid Dynamics during Forced Convective Quenching of Flat-End Cylindrical Probes</b> <i>B. Hernandez-Morales, H.J. Vergara-Hernandez, G. Solorio-Diaz</i>	135
<b>Hopf Bifurcation in the Holling-Tanner Model</b> <i>Manuel Falconi, Martha Garcia, Jaume Llibre</i>	142
<b>On One Approach for Calculation of the Thermal Conductivity Coefficients for Heat Transfer: Part I</b> <i>Janis S. Rimshans, Sharif E. Guseynov, Jevgenijs Kaupuzs</i>	147
<b>On One Approach for Calculation of the Thermal Conductivity Coefficients for Heat Transfer: Part II</b> <i>Janis S. Rimshans, Sharif E. Guseynov, Jevgenijs Kaupuzs</i>	153
<b>Flow-Pressure Conditions in Gas Pipe Networks</b> <i>Jurij Krope, Darko Goricanec</i>	158
<b>Authors Index</b>	163

## Plenary Lecture 1

### Discussion of the Problem on Designing the Global Database for Different Kinds of Quenchants



**Dr. Nikolai Kobasko**  
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**Abstract:** To make computer simulations for heat treating industry possible, especially modeling of the very complicated quenching processes, there is need to have database for cooling capacity of different kinds of quenchants. Unfortunately, there is no such database available for engineers and computer programmers. The three teams in the world were organized to develop desired database. The US team uses standard Inconel 600 probe with the one thermocouple at the core to measure cooling capacity of the quenchants. The Japanese team uses silver probes with the one thermocouple at the core to measure cooling capacity of the quenchants. It is shown that Inconel 600 probe can provide only with the effective heat transfer coefficients which can be used for core cooling rate calculations and are not suitable for temperature fields and residual stress distribution calculations in steel parts during quenching. Silver probes can be used to investigate heat transfer coefficients during full film boiling and to measure critical heat flux densities. During quenching of real steel parts in cold water and water solutions film boiling in many cases is completely absent. That is why the heat transfer coefficient's data received by testing silver probes cannot be used for calculations temperature fields and residual stress distribution in real steel parts during quenching because silver probes create stable full film boiling (due to very high thermal conductivity of silver) and in the same time the film boiling during quenching of real steel parts can be absent. So it is impossible to use the film boiling data as the nucleate boiling data and the nucleate boiling data as the film boiling data. To make generalization possible, the third International WSEAS team uses another approach (see [www.worldses.org/projects/Heat\\_and\\_Mass\\_Transfer.doc](http://www.worldses.org/projects/Heat_and_Mass_Transfer.doc)). 1. First of all, the critical heat flux densities should be measured for different kinds of quenchants. 2. The initial heat flux densities during immersion of steel parts into quenchant should be calculated and compared with the critical heat flux densities. 3. The heat transfer coefficient should be calculated on the basis of testing Liscic probe and solving inverse problem. This approach allows predicting the film or nucleating boiling processes to correctly calculate temperature fields and residual stress distribution. To discuss widely the existing three approaches, the members of all three teams and engineers from universities and big companies are invited to participate in discussion of the problem at the WSEAS Conferences. In the plenary lecture the main achievements of the third team will be widely discussed to accelerate transition from high costly technological processes to less costly technological processes, to increase service life of steel parts and make environment cleaner. There is need to put efforts of the three teams together and to have sponsors from the big companies to further develop appropriate database for heat treating industry.

**Brief Biography of the Speaker:** Dr. Nikolai Kobasko received his PhD from the National Academy of Sciences of Ukraine in 1969. He is a leading expert on quenching and heat transfer during the hardening of steels. He is the author and co-author of more than 250 scientific and technical papers, several books and brochures, and more than 30 patents and certificates. In 2004, Dr. Nikolai Kobasko received the Da Vinci Diamond Award and Certificate in recognition of an outstanding contribution to thermal science. Dr. Nikolai Kobasko is Co-Editor of the WSEAS TRANSACTIONS on HEAT and MASS TRANSFER and is a member of Editorial Board for International Journal of Mechanics (NAUN) and Journal of ASTM International (JAI). He was the Head of the laboratory of the Thermal Physics Institute of the National Academy of Sciences of Ukraine. He is co-founder of two consulting companies: IQ Technologies Inc. Akron, USA (1999) and Intensive Technologies Ltd, Kiev, Ukraine (2000). The aim of both companies is material savings, ecological problems solving and increasing service life of steel parts. In 2009 for substantial and innovative contributions to thermal science and heat treating technologies, including development of novel quenching methods and application of computational models to thermal processes Dr. Nikolai Kobasko was elected as ASM International Fellow (FASM). At present he is the Director of Technology and R&D of IQ Technologies Inc., Akron, USA and also President of the Intensive Technologies Ltd., Kiev, Ukraine. More information is provided in <http://www.intensivequench.com> and <http://www.itl.kiev.ua>.

## Authors Index

Abdullah, A. A.	74	Mankin, R.	87
Alderete Chavez, A.	111	Margus Pinol, C.	100
Amoresano, A.	105	Matko, D.	18
Athamena, K.	29, 126	Medvid, A.	49
Banjar, H. M.	74	Munekage, Y.	38
Banzon, R.	100	Muriel, M.	111
Bhakta, J. N.	38	Niola, V.	105
Ceron Breton, J. G.	111	Para, I.	94
Ceron Breton, R. M.	111	Priimets, J.	87
Damian Hernandez, D. L.	111	Rimshans, J.	49
Falconi, M.	142	Rimshans, J. S.	13, 147, 153
Garcia, M.	142	Rosant, J.-M.	29, 126
Goricanec, D.	158	Sabre, M.	29, 126
Guerra Santos, J.	111	Sajjad, S.	45
Guilhot, J.	29, 126	Salim, M.	38
Guseynov, S. E.	13, 49	Sanchez Junco, R. C.	111
Guseynov, S. E.	147, 153	Sarbu, I.	57, 63, 68
Hernandez-Morales, B.	135	Sini, J. F.	29, 126
Kaupuzs, J.	49	Soika, E.	87
Kaupuzs, J.	13, 147, 153	Solorio-Diaz, G.	135
Kobasko, N.	81, 117	Stanciu, D.	94
Kolar, V.	23	Tomazic, T.	18
Krope, J.	158	Valea, E. S.	63, 68
Langella, F.	105	Vergara-Hernandez, H. J.	135
Llibre, J.	142	Vinet, J.	29, 126