



# 6th WSEAS International Conference on HEAT and MASS TRANSFER (HMT'09)

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## The 6th WSEAS International Conference on HEAT and MASS TRANSFER (HMT'09)

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### Plenary Lecture 1:



Heat Transfer, Thermal Energy and Entropy -  
Demystified

by [Prof. M. Kotic](#), Northern Illinois University , U.S.A

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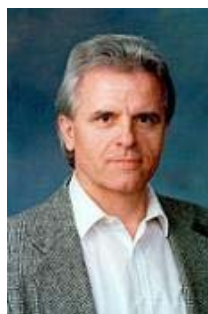
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## Plenary Lecture

### Heat Transfer, Thermal Energy and Entropy - Demystified



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**Abstract:** The concept of temperature, thermal energy and heat transfer, and entropy and entropy generation, are all different physical concepts but strongly interrelated. They are all associated with randomized energy redistribution and storage within material systems, and randomized energy transfer in time within and between systems through their real or imaginary interface surfaces. Heat transfer is known as typical spontaneous irreversible process where all organized (structural) energies are disorganized or dissipated as thermal energy with irreversible loss of energy potential (from high to low temperature) and overall entropy increase.

These fundamental concepts will be revisited and highlighted with typical examples and characteristic natural processes with an objective to explain, clarify, and resolve any confusion by correlating and unifying different approaches and nomenclature, related to the universal concept of energy. The fundamental Thermodynamic Laws of Nature are defining and unifying all existence (all natural systems defined by their properties) and all changes (all artificial and natural processes, including life), which are in turn caused by energy transfer from one system or subsystem to another. Due to universality and diversity of Thermodynamics (the Laws of natural and/or man-made processes and properties), it appears to be abstract and difficult to comprehend, regardless that the Laws of Nature are obvious, logical and simple. The basic concepts will be thoroughly defined and illustrated first by simple ideal systems and reversible processes, and then expended to real systems and unavoidable process irreversibilities.

The heat transfer and thermal energy are unique and universal manifestation of all natural and artificial (man-made) processes, and thus are vital for more efficient cooling and heating in new and critical applications, including energy production and utilization, environmental control and cleanup, and bio-medical applications.

#### Brief Biography of the Speaker:

Professor Kostic's teaching and research interests are in Thermodynamics (a science of energy, the Mother of All Sciences), Fluid Mechanics, Heat Transfer and related

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fluid-thermal-energy sciences; with emphases on physical comprehension and creative design, experimental methods with computerized data acquisition, and CFD simulation; including nanotechnology and development of new-hybrid, POLY-nanofluids with enhanced properties, as well as design, analysis and optimization of fluids-thermal-energy components and systems in power-conversion, utilizations, manufacturing and material processing. Dr. Kostic came to Northern Illinois University from the University of Illinois at Chicago, where he supervised and conducted a two-year research program in heat transfer and viscoelastic fluid flows, after working for some time in industry.

*"Kostic's unique synergy of philosophical, theoretical, computational and experimental approach, results in open mind, intense curiosity and sharp focus for identifying and analyzing natural and engineering phenomena with high motivation for problem identification, troubleshooting and solving."*

Kostic received his B.S. degree with the University of Belgrade Award as the best graduated student in 1975. Then he worked as a researcher in thermal engineering and combustion at The Vinca Institute for Nuclear Sciences, which then hosted the headquarters of the International Center for Heat and Mass Transfer, and later taught at the University of Belgrade in ex-Yugoslavia (\*). He came to the University of Illinois at Chicago in 1981 as a Fulbright grantee, where he received his Ph.D. in mechanical engineering in 1984. Subsequently, Dr. Kostic worked several years in industry. In addition, he spent three summers as an exchange visitor in England, West Germany, and the former Soviet Union.

Dr. Kostic has received recognized professional fellowships and awards, including multiple citations in Marquis' "Who's Who in the World" and "Who's Who in Science and Engineering"; the Fulbright Grant; NASA Faculty Fellowship; Sabbatical Semester at Fermilab as a Guest Scientist; and the summer Faculty Research Participation Program at Argonne National Laboratory. He is a frequent reviewer of professional works and books in Thermodynamics and Experimental Methods. Dr. Kostic is a licensed professional engineer (PE) in Illinois and a member of the ASME, ASEE, and AIP's Society of Rheology. He has a number of publications in refereed journals, including invited state-of-the-art chapters in the Academic Press series Advances in Heat Transfer, Volume 19, and "Viscosity" in CRC Press' Measurement, Instrumentation and Sensors Handbook; as well as invited reference articles: Work, Power, and Energy in Academic Press/Elsevier's Encyclopedia of Energy; Extrusion Die Design in Dekker's Encyclopedia of Chemical Processing; and Energy: Global and Historical Background and Physics of Energy in Taylor & Francis/CRC Press Encyclopedia of Energy Engineering and Technology. Professor Kostic is a member of the Graduate Faculty at Northern Illinois University . More at: <http://www.kostic.niu.edu>