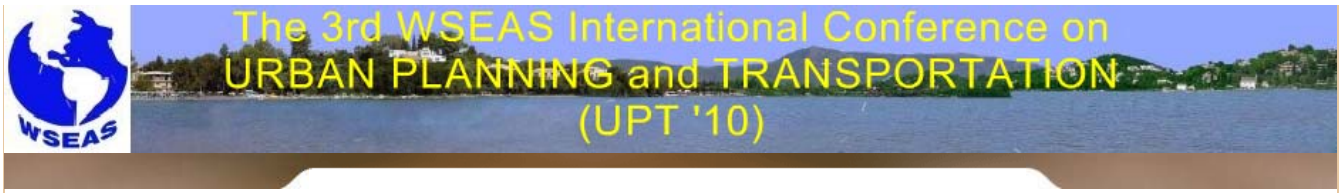

menu

Main Page
Call For Papers
Location
Chair-Committee
Deadlines
Paper Format
Fees
Submit a Paper
Submit Special Session
Send the Final Version
Conference Program
Presentation
Information
Call For Collaborators
Relevant WSEAS events
Reviewers
Contact us

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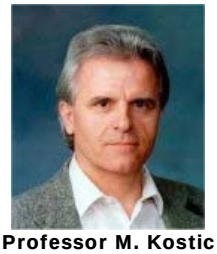
CONFERENCES
JOURNALS
BOOKS
RESEARCH
INDEXING
FAQ
E-LIBRARY
REPORTS
HISTORY
NEWS
EXPIRED

Plenary Lecture

news

Analysis and CFD Simulation of Flooding Flows and Scouring Around Bridges and Transportation Structures



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Abstract: Bridges are significant component of the urban and ground transportation infrastructure. The 'bridge hydraulic analysis and design' could be substantially enhanced using advanced commercial Computational Fluid Dynamics (CFD) software and powerful parallel computing resources. Key objectives are to evaluate the capabilities of the state-of-the-art CFD codes for the prediction of experimental results for lift and drag forces and scouring on inundated bridges, conducted at Turner-Fairbank Highway Research Center (TFHRC), and the development of "best practices" for the application of the CFD. These research activities are part of a multi-year program initiated by Argonne National Laboratory with the US Department of Transportation (USDOT), to establish the Transportation Research and Analysis Computing Center (TRACC), a national supercomputing user facility for advanced computing, visualization, and high-speed networking, based on a massively parallel computer system.
Early results have focused on the examination and determination of best practices, with emphasis on mesh spacing, time step selection and turbulence modeling. Preliminary two-dimensional model results show reasonable agreement with limited experimental data. Present work focuses on further development and optimization of the simulation methods and development of three-dimensional scouring models.
Future activities will address diverse research needs of the transportation community in bridge hydraulics, including the assessment of lift and drag forces on bridge decks when flooded, analysis of sediment transport and its influence on scouring, optimization of bridge deck-shapes to minimize flow forces and pressure flow scour, evaluation of active and passive scour countermeasures, and addressing environmental issues such as fish passage through culverts.

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 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 received his Dipl-Eng (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 Belgrade-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," "Who's Who in America," "Who's Who in American Education," 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 or P.Eng.) 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, both in Taylor & Francis/CRC Press Encyclopedia of Energy Engineering and Technology. Professor Kostic is a senior member of the Graduate Faculty at Northern Illinois University. More at: http://www.kostic.niu.edu