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BIOGRAPHICAL INFORMATION

Professor Emeritus Michael P. Wnuk has taught Engineering Mechanics at the University of Wisconsin Milwaukee for more than 20 years. In 1968 he completed his post-doctoral studies at California Institute of Technology in Pasadena, CA, specializing in Aeronautical Engineering. His paper resulting from the NASA supported research at Caltech won a reward at the IUTAM Congress at Stanford University in August 1968. He has also taught and performed research at various schools in the United States, including Michigan State University, Stanford University, California Institute of Technology and Northwestern. Dr. Wnuk has also worked abroad in England, Poland (his native country), Germany, Russia, Italy, Yugoslavia and China. In 1970 he worked as a Distinguished Visiting Scholar in the Department of Applied Mathematics and Theoretical Physics at the University of Cambridge, UK. The British Science Council and the Office of Naval Research of the US have sponsored his research there. The other sponsors of his researches include NATO, NASA, the National Science Foundation, National Academy of Sciences and the National Institute of Standards and Technology.

In 1991, he was appointed a Fulbright Scholar, and in 1992, he received the Lady Davies Scholarship from the Government of Israel. He is a member of the Sigma Xi Research Society, an Associate Member of the Cambridge Philosophical Society in England, member of the American Academy of Mechanics, and a life member of the New York Academy of Sciences.

Dr. Wnuk is one of the co-founders and a co-chairman of the International Conference and Research Workshops on Mesomechanics, which convenes every two years (in 1996, Tomsk, Siberia, in 1998, Tel Aviv, in 2000 in China, and in 2002 in Denmark at the Aalborg University) in order to merge interdisciplinary research of high-tech nature.
involving Physics at nano-scale, Materials Engineering and Mechanics. He has been selected an ASEE/NASA Summer Faculty several times; in 1966 at the Johnson Space Center NASA White Sands Test Facility in New Mexico, and then in 1998, 1999, 2000, 2001, 2002 and 2003 at California Institute of Technology/Jet Propulsion Laboratory in Pasadena, California. Some of his recent work pertains to the bio-medical applications of Mechanics of Continuous Media, in particular Fluid Mechanics describing flow of non-newtonian multi-phase fluids, such as flow of blood in the human arteries.

Since 1987 Dr. Wnuk serves as President of the Panslavia International Research Institute, Inc., which assists multinational partners in trade, science and technology transfer with particular emphasis on global problems of ecology and bio-medical R&D. His most recent research is focused on the alternative fuels such as synthetic carbon-based fuels and/or organically derived additives to the traditional gasoline fuel. This research is of multidisciplinary nature, combining Physics, Chemistry, Hydrodynamics and the principles of Continuum Mechanics.

Pertinent data may also be found at the Internet using the address www.uwm.edu/~mpw or by writing an email at any of the addresses given above.

Seminar Lecture at the Department of Mechanical Engineering, Cracow University of Technology. Abstract and brief CV of the speaker, Prof. Michael P. Wnuk.

FROM MACRO TO MESO AND NANO MATERIAL FAILURE. QUANTIZED COHESIVE MODEL FOR FRACTAL CRACKS

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Abstract. A discretization procedure for the cohesive model of a fractal crack requires that all pertinent entities describing the influence of the cohesive stress that restrains opening of the crack, such as effective stress intensity factor, the modulus of cohesion, extent of the end zone and the opening displacement within the high-strain region adjacent to the crack tip are re-visited and replaced by certain averages over a finite length referred to as either “unit step growth” or “fracture quantum”. Thus, two novel aspects of the model enter the theory: (1) degree of fractality related to the roughness of the newly created surface, and (2) discrete nature of the propagating crack. Both variables are shown to increase the equilibrium length of the cohesive zone. At the point of incipient fracture this length becomes the characteristic material length parameter $L_c$. Novel properties of the present model provide a better insight and an effective tool to explain multiscale nature of fracture process and the associated transitions from nano- to micro- and macro-levels of material response to deformation and fracture. These multiscale features of any real material appear to be inherent defense mechanisms provided by Nature.