DISTINGUISHED LECTURER SERIES

VCU
MECHANICAL ENGINEERING

Marvelous Mathematical Models

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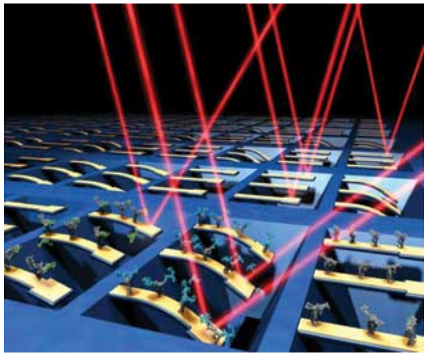
Social Hour: 11:30-12:00 noon
Seminar: 12:00–1:00 pm
Room 106
Engineering Building

ABSTRACT

Mathematical models have played an important role in science and engineering from the earliest times. Mathematical models come in many forms, from the crude to the refined. At the end of the day, the ones that survive are the simple ones that capture the essence of a phenomenon in a non-trivial way. There is a quote attributed to Einstein that "A scientific theory should be as simple as possible, but no simpler." The best mathematical models - the ones I am referring to as "marvelous" - have this quality. They are simple, even elegant in their statement. They capture the essence of the phenomenon being modeled. And, ideally, the model will give rise to interesting mathematical results and will raise fundamental issues. Mathematical models come in many forms: deterministic, stochastic, with continuous or discrete variables, explicit or "white box", "black box", etc. In mechanics most models are continuous and "white-box". Most are deterministic. Some are stochastic. I will highlight three models I have worked on, and one that I hope to work on in the future. These are (i) point vortices from 2D ideal hydrodynamics; (ii) models of the statics and dynamics of dry foam; (iii) the Schmolukowski equation of coagulation; and (iv) L-systems, a modeling tool for biological structures. For each I will provide an overview of the nature of the model, the type of results it produces, and some of the work I have been involved with regarding this model. The talk should be accessible to a broad audience, including graduate students, with an interest in modeling and numerical simulation.



BIO

Hassan Aref is the Reynolds Metals Professor of Engineering Science and Mechanics and former Dean of Engineering at Virginia Tech. He currently splits his time between Virginia Tech and Technical University of Denmark where he is the Niels Bohr Visiting Professor. Prior to moving to Virginia Tech, Aref was Professor and Head of Theoretical & Applied Mechanics at University of Illinois, Urbana-Champaign from 1992 to 2003. Before coming to Illinois Aref was on the faculty at University of California, San Diego. Aref did his PhD in Physics at Cornell University and started his faculty career in the Division of Engineering at Brown University. His undergraduate work, through the degree of *cand. scient.* in physics and mathematics, was done at University of Copenhagen and the Niels Bohr Institute. Aref has been involved in editorial work throughout his career, starting as associate editor for Journal of Fluid Mechanics. He is currently co-editor of Advances in Applied Mechanics, and is a member of several editorial boards. He has published in the best journals at a consistent rate of about 3–4 papers per year and has continued a research program while doing administrative work. He has participated in funded research of about $65M from NSF, DoE, ONR, AFOSR, NASA and DARPA. His research has been recognized by professional societies through fellowships and awards, and by numerous invitations to present lectures worldwide. Aref is a fellow of the American Physical Society, the American Academy of Mechanics and the World Innovation Foundation, and the winner of the APS Otto Laporte Award.

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