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IMI Distinguished Lecture Series

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Collective Dynamics: Consensus, the Emergence of Leaders and Social Hydrodynamics

Professor Eitan Tadmor

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http://www.cscamm.umd.edu/people/faculty/tadmor/

THURSDAY
March 17

4:30 - 5:30 PM
LeConte College
Room 412

Refreshments at 4:00 PM
Wyman L. Williams Room

Nature and human society offer many examples of self-organized behavior: ants form colonies, birds flock together, mobile networks coordinate their rendezvous, and human opinions evolve into parties. These are simple examples for collective dynamics, in which local interactions tend to self-organize into large scale clusters of colonies, flocks, parties, etc. We discuss the dynamics of such systems, driven by “social engagement” of agents with their neighbors.

We will focus on two natural questions which arise in this context. First, what is the large time behavior of such systems? The underlying issue is how different rules of engagement influence the formation of large scale patterns such as clusters, and in particular, the emergence of “consensus”. We propose an alternative paradigm based on the tendency of agents “to move ahead” which leads to the emergence of trails and leaders.

Second, what is the group behavior of systems which involve a large number of agents? Here one is interested in the qualitative behavior of the group rather than tracing the dynamics of each of its agents. Agent-based models lend themselves to kinetic and hydrodynamic descriptions. It is known that smooth solutions of “social hydrodynamics”, if they exist, must flock. Do such smooth solutions exist? Alignment-based models reflect the competition on resources which may lead to finite-time singularities. We discuss the global regularity of social hydrodynamics for sub-critical initial configurations.

Brief Bio

Eitan Tadmor is a Distinguished University Professor at the University of Maryland (UMd), College Park, and the Director of the university Center for Scientific Computation and Mathematical Modeling (CSCAMM).

Tadmor’s primary research interests include analysis of time-dependent problems, the development of high-resolution algorithms for the approximate solution of such problems, and the interplay between analytical theories and computational aspects with applications to shock waves, kinetic transport, incompressible flows, image processing and models for self-organized dynamics.

Tadmor received his Ph.D. in Mathematics from Tel Aviv University in 1979, and he began his scientific career as a Bateman Research Instructor in CalTech, 1980-1982. He held professorship positions at Tel-Aviv University, 1983-1998, where he chaired the Department of Applied Mathematics from 1991-1993, and at UCLA, 1995-2004, where he was the founding co-director of the NSF Institute for Pure and Applied Mathematics (IPAM) from 1999-2001. Since 2002, he has served on the faculty of the Department of Mathematics and the Institute for Physical Sciences and Technology at UMd, where he was recently awarded as the PI of the NSF Research network KI-Net.

Tadmor held visiting positions in the universities of Michigan, Paris VI, Brown and at the Courant Institute. He serves on the editorial boards of more than a dozen leading international journals and has given numerous invited lectures, including plenary addresses in the international conferences on hyperbolic problems in 1990 and 1998 and an invited lecture in the 2002 International Congress of Mathematicians. In 2015 Tadmor was awarded the SIAM-ETH Peter Henrici prize for “original, broad, and fundamental contributions to the applied and numerical analysis”. Tadmor is an AMS Fellow who was listed on the ISI most cited researchers in mathematics. He published more than one hundred and fifty research papers, mostly in Numerical Analysis and Applied Partial Differential Equations.

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