

The Eighth Yehuda Leib Golomb Annual Lecture in Applied Mathematics

Dedicated to the memory of Rav Elchanan Tzvi
b-Reb Yehudah Lev Ha-Cohen Golomb



Consensus & flocking: examples of self-organized dynamics

Biography

Eitan Tadmor is a Distinguished University Professor at the University of Maryland, College Park and the Director of the university Center for Scientific Computation and Mathematical Modeling (CSCAMM). He received his bachelor's degree in 1973 and his Ph.D. in Mathematics from Tel Aviv University in 1979.

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

Tadmor began his scientific career at 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, has served on the faculty of the Department of Mathematics and the Institute for Physical Sciences and Technology (IPST) at the University of Maryland.

Tadmor has held visiting positions at 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 at the international conferences on hyperbolic problems in 1990 and 1998 and an invited lecture at the 2002 International Congress of Mathematicians. Tadmor is on the ISI list of most cited researchers in mathematics. He has published more than one hundred and forty research papers, mostly in Numerical Analysis and applied Partial Differential Equations.

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Abstract: Self-organized dynamics is driven by "rules of engagement", which describe how each agent interacts with its "neighbors". They consist of long-term attraction, mid-range alignment and short-range repulsion. Many self-propelled models are driven by the balance between these three forces, which yield emerging structures of interest. Examples in social contexts include the consensus of voters, traffic flows, or evolution of languages, and examples of biological processes include the formation of flocks of birds or schools of fish, tumor growth etc.

We will survey a few recent examples of such models driven by self-alignment. In particular, we introduce a new particle-based model which, we argue, addresses several drawbacks of existing models for self-organized dynamics. The model is independent of the number of agents: only their geometry in phase space is involved. We will explain the emerging behavior of flocking in the proposed model, when the pairwise long-range interactions between its agents decay sufficiently slowly. The methodology presented here is based on the new notion of active sets, which carries over from particle to kinetic and hydrodynamic descriptions, and we discuss the unconditional flocking at the level of hydrodynamic description.

Thursday, 14 Sivan 5771, June 16, 2011, at 1:00 p.m.

Hochstein Building, Room 160,
Machon Lev Campus, Givat Mordechai, Jerusalem

יום חמישי, י"ד בסיון תשע"א (16.6.11) בשעה 13:00

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