COMPLEX SYSTEMS SEMINAR

DEC 12, 9AM, 422 DAVIS CENTER

"What causes Jetlag?"

Hava T. Siegelmann
UMass Amherst (Computer Science) &
Harvard University (Evolutionary Dynamics)

Systems in the body demonstrate different levels of alertness with respect to the rotation of earth and as governed by the circadian system. Organs' desyncrhonicity as occurring after travel and in shift workers was assumed to result by different re-entrainment rates of system components when following the change of phase in the master clock, the Supra Chariasmatic Nuclei (SCN). While simple, this assumption did not explain data where relative desyncrhonicity reach complete relative opposition. Collecting available data, we created a multistage non-linear system level modeling, were organs are characterized based on their actual dynamical oscillation patterns and are connected by the coupling strengths and relative delays. Our model demonstrates that the chief source of desyncrhonicity among organs reaches its peak following eastward phase advance of 5-8 hours time zones, and it occurs since some (not all) organs advance their clocks, following the SCN, by repetitive delays. This phenomena is termed ``antidromic reentrainment." Antidromic reentrainmnet explains the relative anti-correlated phases among organs. Studying the effect of the light protocols on the reentrainment, light protocols were proposed that reduce both relative phases and total reentrainment time following harsh changes in time zones (T. Leise and H. T. Siegelmann, "Dynamics of a multistage circadian system," Journal of Biological Rhythms, 21(4):314-323. 2006).

SPEAKER BIO:

Dr. Siegelmann received her BA in Computer Science from Technion University Summa Cum Laude, was awarded an Artist Certificate in Piano from the Rubin Conservatory in 1982, and received the State of Israel Best Undergraduate Medal in 1984. She completed her MSc in Computer Science Cum Laude at Hebrew University in 1992 with a thesis entitled "Document Allocation in Multiprocessor Information Retrieval Systems: An Application of Genetic Algorithms". One year later in 1993 she received her PhD in Computer Science from Rutgers as a "Doctoral Fellow of Excellence" where she completed her dissertation work on "Foundation of Recurrent Neural Networks". She was awarded the Alon Fellowship of Excellence of the Israeli National Committee for Higher Education which funded her research from 1994-1997, and in 1998 she published her book "Neural Networks and Analog Computation: Beyond the Turing Limit". She is currently an associate professor of Computer Science at U. Mass, Amherts, where she is Director of the Biologically Inspired Neural and Dynamical Systems Lab. She has 48 refereed journal articles published or in press in several prestigious computer science and interdisciplinary journals (including Science), 19 book chapters, and 50 conference papers. Her work has also received wide recognition in the popular media such as NPR and numerous magazines and newspapers. She is an associate editor for Frontiers in Computational Neuroscience, and is on the editorial board of the American Inst. of Physics Journal Chaos: An interdisciplinary Journal of Nonlinear Science. In 2007 we were fortunate to have her join our UVM CS Board of Advisors.