

Lennaert van Veen, PhD

Associate Professor and Graduate Program Director, Modelling and Computational Science, Faculty of Science at University of Ontario Institute of Technology

Oshawa, ON, CA

Using applied and computational dynamical systems theory to build a better understanding of physical and physiological processes

Description

Mathematically speaking, the complexity of the human brain and the unstable nature of turbulence really aren't all that different. In fact, in spite of their peculiarities, the analysis techniques are very similar for these nonlinear dynamical systems. Lennaert van Veen, PhD, Associate Professor and Graduate Program Director of Modelling and Computational Science in the Faculty of Science, explores the application of dynamical systems theory to complex phenomena and high-dimensional chaos.

A Project Leader with UOIT's Collective Lab for Applied and Interdisciplinary Mathematics (CLAIM), his latest research focuses on transitions and pattern formation in physical and physiological systems with applications in fluid turbulence, as well as cortical dynamics of depression, both of which have been poorly understood. Dr. van Veen is investigating ways to model the human cortex and develop novel computational techniques for turbulence. His research will expand the knowledge of how these systems function, and feed into research to develop advanced techniques for minimizing turbulence, as well as create novel strategies for less invasive brain control, with the ultimate goal of curing brain disorders.

He completed his Master of Science in Theoretical Physics at the University of Amsterdam, and received his Doctorate in Applied Mathematics at the Utrecht University and the Royal Dutch Meteorological Institute in Bilt, Netherlands. Subsequently, he was awarded successive post-doctoral fellowships by the Japan Society for the Promotion of Science, and the Australian Research Council Centre of Excellence for Mathematics and Statistics of Complex Systems.

In 2007, Dr. van Veen was appointed Assistant Professor in the Department of Mathematics and Statistics at Concordia University in Montreal, Quebec, and continued to serve as an Adjunct Assistant Professor until 2011. Broadening his international teaching experience, he was named a Researcher in Residence for the Research Experiences for Undergraduates program at the Rochester Institute of Technology in New York, and taught in the Geophysical Fluid Dynamics program of the Woods Hole Oceanographic Institution in Massachusetts. He continues to share his expertise via Virtual Researcher on Call (www.vroc.ca), enabling secondary school students to access interviews discussing his research topics.

Industry Expertise

Education/Learning, Research, Aerospace, Program Development

Topics

Applied Mathematics, Bifurcation Theory, Climate Dynamics, Complex Dynamics in Mean-Field Models of the Cortex, Computational Neuroscience, Dynamical Systems Theory, Fluid Dynamics, Numerical Analysis, Periodic and Connecting Orbits Embedded in Turbulence, Sub-Critical Transitions to Turbulence, Theoretical Physics

Affiliations

Organization for Computational Neurosciences, American Physical Society , Canadian Applied and Industrial Mathematics Society , Society for Industrial and Applied Mathematics , Shared Hierarchical Academic Research Computing Network (SHARCNet)

Past Talks

Equilibria and Periodic Orbits in 3D Navier-Stokes Flow on a Periodic Domain
2015 CMS Winter Meeting

Sub-Critical Transition Without Walls Workshop on Advancing Wall-Turbulence Model Development and Implementation
University of New Hampshire Workshop

Simple Invariant Solutions in Homogeneous Isotropic Turbulence with Various External Forces
Sixth International Symposium on Bifurcations and Instabilities in Fluid Dynamics

Numerical Solution of the Kuramoto-Sivashinsky Initial-Boundary Value Problem
Canadian Applied and Industrial Mathematics (CAIMS) 2015 Annual Meeting

Bifurcations and Self-Organisation in a Continuum Model of the Human Cortex
Advanced Computational and Experimental Techniques in Nonlinear Dynamics Workshop

Pattern Formation in a Mean-Field Model of Electrocardiac Activity
23rd Annual Computational Neuroscience Meeting

Meta-Bifurcation Analysis of a Mean-Field Model of the Human Cortex
Society for Applied and Industrial Mathematics (SIAM) Conference on the Life Sciences

Turing Instabilities in a Mean-Field Model of Electrocardiac Activity
22nd Annual Computational Neuroscience Meeting

Dynamics of a Mean-Field Cortex Model
SIAM Conference on Nonlinear Waves and Coherent Structures

Pattern Formation and Nonlinear Oscillations in a Neural Population Model
2012 Annual Meeting of the Cognitive Neuroscience Society

Education

Utrecht University and the Royal Dutch Meteorological Institute
PhD Applied Mathematics

University of Amsterdam
MSc Theoretical Physics

Accomplishments

Long-Term Invitation Fellowship, Japan Society for the Promotion of Science (JSPS)

Dr. van Veen was awarded a seven-month fellowship at the Faculty of Engineering Science at Osaka University in Japan.

Editor, Society of Applied and Industrial Mathematics (SIAM) Activity Group on Dynamical Systems

Dr. van Veen is Editor of SIAM's Dynamical Systems magazine. Previously, he served as secretary of SIAM's Activity Group, magazine editor-in-chief and portal editor-in-chief, each for two years.

Post-Doctoral Fellow, Australian Research Council Centre of Excellence

During his two-year fellowship, Dr. van Veen's research examined mathematics and statistics of complex systems.

Post-Doctoral Fellow, JSPS

During his two-year fellowship, Dr. van Veen explored research at the National Institute for Fusion Science in Toki, Gifu Prefecture, and the Department of Mechanical Engineering at Kyoto University.

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