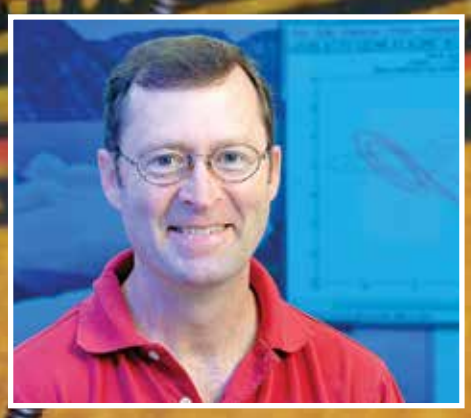
G. Milton Wing Lecture Series

October 2015



With Kevin Short

Professor,
Department of Mathematics,
University of New Hampshire

The Math Behind the Music

Public Lecture

Wed., October 7, 4:50–6:05 p.m.
Hubbell Auditorium, Hutchison Hall

This talk is designed to show how a mathematical analysis of music naturally leads to coverage of many topics from high school mathematics, including exponentials, logarithms, sinusoids, complex numbers, matrix multiplication, trig identities, and algebra. The goal is to show how a study of music can provide a practical application of high school mathematics that also serves to integrate concepts from several courses and might be a suitable topic for a capstone course for some students. The talk includes audio, video, and graphics so that the audience can hear and see the music.

Cupolets in Chaos, Not Verse

Wednesday, October 7, 2–3:15 p.m.
Dewey Hall, Room 1101

An important topic in the study of nonlinear chaotic systems is how to control the system dynamics. This talk focuses on one method that has proven to be useful in several practical applications, whereby (approximate) unstable periodic orbits of chaotic systems are stabilized onto what we have called cupolets (chaotic unstable periodic orbit-lets). The method of stabilization is efficient enough to produce a library of thousands of cupolets. The talk covers how knowledge of the cupolets and their stabilization method when combined with graph theory and variants of Dijkstra's algorithm can be used to efficiently steer the dynamics of the chaotic systems from one cupolet state to another. A method will also be proposed to determine if some cupolets are "fundamental" rather than "composite." If time permits, discussion of mutually stabilizing cupolet states may be discussed.

The Cocktail Party Problem

Thursday, October 8, 11:05 a.m.–12:20 p.m.
Hylan Hall, Room 202

This talk focuses on mathematically analyzing the soundscape of a room so that the sound sources can be identified and manipulated. It will be shown that, using super-resolution techniques in the frequency domain, it is often possible to convert smeared-out sounds to "threads" of sound that can be attributed to a given source and then separated. Once separated, it is possible to amplify the speech of a desired speaker while simultaneously dropping the decibel level of the background noise or other speakers. Further, in the new representation, it is possible to mitigate reverberant effects to produce a more focused sound. The work is designed to improve speech clarity and speech recognition systems with the eventual goal to integrate the algorithms into hearing aids or personal sound-amplification devices.

UNIVERSITY COMMUNICATIONS • 1676-50-9151DC

Lecture Series Sponsored by the Department of Mathematics

UNIVERSITY of ROCHESTER