

TEMPLE UNIVERSITY
Department of Mathematics

Applied Mathematics and Scientific Computing Seminar

Wednesday, 20 March 2013, 4:00 p.m.
Room 617 Wachman Hall

(refreshments and social at 3:45 p.m)

The spectral analysis of the neural control of walking

by Tim Kiemel
University of Maryland

Abstract. Frequency response functions (FRFs) play a central role in the system identification and analysis of linear control systems. For example, we have used FRFs to identify the plant and feedback control law for the neural control of standing, a system can be usefully approximated as linear. Here we describe an analogous method of spectral analysis applicable to the neural control of walking, which we idealize as having limit-cycle dynamics. The method uses harmonic transfer functions (HTFs) to approximate the input-output mapping for small perturbations of a limit cycle that do not cause phase resetting. To include the effects of phase resetting, we use a second HTF that describes the effect of the perturbation on an approximation of the phase of the limit cycle. By combining both HTFs, we obtain a characterization of the input-output mapping of the perturbation that does not depend on the particular phase approximation. We illustrate the method using simulated data and apply the method to describe the effect of visual-scene motion on walking