TEMPLE UNIVERSITY
Department of Mathematics

Applied Mathematics and Scientific Computing Seminar

Wednesday, 13 January 2016, 4:00 p.m.
Room 617 Wachman Hall

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

The solution of coupled integral equations using a tensor product interpretation

by Kirk Soodhalter
Johannes Kepler University, Linz, Austria

Abstract. We investigate the efficient solution of a set of coupled ordinary differential equations arising from a model describing vibrations of a wind turbine induced by imbalances of its spinning blades. The forward problem (computing vibrations from imbalances) admits a coupled integral equation formulation. Each integral equation is solved over the same underlying Hilbert space $\mathbb{H}$. We observe that these coupled integral equations can be represented as one compact operator acting on the tensor product space $\mathbb{R}^N \otimes \mathbb{H}$, where N is the number of coupled equations. A Galerkin discretization leads to a linear system of dimension nN with corresponding Kronecker product structure, where n is the number of basis elements used to discretize $\mathbb{H}$. Such systems can be solved using a variety of techniques which exploit the Kronecker structure. We demonstrate the effectiveness of exploiting the tensor structure with numerical experiments and show that our results agree with data recorded from actual wind turbines.