1086-65-1783 **Keith J Wojciechowski*** (wojciechowskik@uwstout.edu), University of Wisconsin-Stout, 202D Jarvis Hall Science Wing, 410 10th Avenue East, Menomonie, WI 54751, and **Kristian Sandberg**.
The EPS Method: A New Method for Constructing Pseudospectral Differential Operators.

In this talk we demonstrate new types of derivative matrices for pseudospectral methods. The norm of these matrices grows at the optimal rate $\mathcal{O}(N^2)$ for N-by-N matrices in contrast to standard pseudospectral constructions that result in $\mathcal{O}(N^4)$ growth of the norm. The smaller norm offers an advantage when using the derivative matrix for solving time dependent problems. The construction is based on representing the derivative operator as an integral kernel composed of singular functions so the matrices naturally incorporate the boundary conditions of the problem and do not rely on the interpolating polynomials. We provide numerical results for the new construction and demonstrate that the construction achieves similar or better accuracy than traditional pseudospectral derivative matrices, while resulting in a norm that is orders of magnitude smaller than the standard construction. To demonstrate the advantage of the new construction, we apply the method for solving a variety of linear and nonlinear PDEs in both rectangular and polar geometries. (Received September 24, 2012)