

University of Colorado at Boulder  
Department of Applied Mathematics

## Comprehensive Examination

Friday, April 25, 2014

10:00 a.m.

PUT LOCATION HERE

**Presenter**

Greg Barnett

**Title**

Polyharmonic Splines with Polynomials for the Numerical Solution of  
Convective PDEs

Conventional radial basis function (RBF) methods for PDEs offer geometric flexibility and high orders of accuracy, with no need for a mesh [1]. Derivative approximations are based only on function values at scattered node locations. The more recently developed RBF-generated finite differences (RBF-FD) approach is computationally much faster, since all derivative approximations are local. However, a direct application of RBF-FD eventually suffers from saturation errors (failure of convergence under refinement), and has been restricted to small stencil-sizes for problems with boundaries [3].

We have found that RBF-FD can be improved dramatically by augmenting the RBF basis with polynomi-