Spring 2016

Mathematical Sciences Colloquium

Meshfree finite difference methods for fully nonlinear elliptic equations

The relatively recent introduction of viscosity solutions and the Barles-Souganidis convergence framework have allowed for considerable progress in the numerical solution of fully nonlinear elliptic equations. Convergent, wide-stencil finite difference methods now exist for a variety of problems. However, these schemes are defined only on uniform Cartesian meshes over a rectangular domain. We describe a framework for constructing convergent meshfree finite difference approximations for a class of nonlinear elliptic operators. These approximations are defined on unstructured point clouds, which allows for computation on non-uniform meshes and complicated geometries. Because the schemes are monotone, they fit within the Barles-Souganidis convergence framework and can serve as a foundation for higher-order filtered methods. We present computational results for several examples including problems posed on random point clouds, computation of convex envelopes, obstacles problems, Monge-Ampere equations, and non-continuous solutions of the prescribed Gaussian curvature equation.

Speaker: Brittany Froese

(NJIT)

Monday, March 28, 2016

Time: 4:00 – 5:00 PM

Location: AE214

Host: Rongjie Lai

Rensselaer