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Computational Mathematics Seminar Series

### Numerical Solution of the Optimal Transportation Problem Via Viscosity Solutions of the Monge-Ampere Equation

**Brittany Froese, University of Texas at Austin**

Postdoctoral Fellow

Johnston Hall 338
January 29, 2013 - 03:30 pm

**Abstract:**

Despite the importance of optimal transportation in both theoretical and applied mathematics, the computation of solutions remains an extremely challenging problem.  We describe a numerical method for the widely-studied case when the cost is quadratic and mass is being mapped onto a convex set.  The solution is obtained by solving the Monge-Ampere equation, a fully nonlinear elliptic partial differential equation (PDE), coupled to a non-standard implicit boundary condition.  First, we describe a variational formulation of the PDE operator, which enables us to construct a monotone finite difference discretisation.  This is used as the foundation of a more accurate, almost-monotone discretisation.  Next, we re-express the transport condition as a Hamilton-Jacobi equation on the boundary.  We construct an upwind discretisation of this equation that only requires data inside the domain.  Using the theory of viscosity solutions, we prove convergence of the resulting method.  A range of challenging computational examples demonstrate the effectiveness and efficiency of this method.

**Speaker's Bio:**

Brittany Froese is currently an NSERC Postdoctoral Fellow in the Department of Mathematics at the University of Texas at Austin.  She received her Ph.D. from Simon Fraser University in Vancouver, Canada.  Her research focuses on the development of numerical methods for solving nonlinear partial differential equations and optimal mass transportation.

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