Numerical Analysis and Scientific Computing Seminar

Numerical methods for surface PDEs

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Abstract: Numerical methods for solving PDEs posed on (evolving) manifolds recently received considerable attention. Applications include image processing, pattern formation and fluid dynamics. One example of our particular interest is multiphase fluids models if one takes so-called surface active agents into account. Distribution of the active agents on the free surface separating different fluids is modeled by a diffusion-transport equation posed on the surface. In this talk we review a level-set method for the free surface capturing and some existing approaches of surface PDEs numerical treatment. Further we focus on a new finite element method for the discretization of elliptic partial differential equations on surfaces. It appears that the method is particularly suitable for problems in which there is a coupling of the problem in the outer domain with the equation on a surface and the surface is given implicitly and may vary in time. We present an error analysis of the method and discuss numerical properties of the corresponding linear algebraic systems.

Wednesday, August 25, 2010, 4:00 pm
Mathematics and Science Center: W306

Mathematics and Computer Science
Emory University