Computational Mathematics Seminar Series

Numerical homogenization of heterogeneous fractional Laplacians

Joscha Gedicke, University of Vienna

Digital Media Center 1034
October 24, 2017 - 03:30 pm

Abstract:

In this talk, we develop a numerical multiscale method to solve the fractional Laplacian with a heterogeneous diffusion coefficient. The fractional Laplacian is a non-local operator in its standard form, however the Caffarelli-Silvestre extension allows for a localization of the equation. This adds a complexity of an extra spacial dimension and a singular/degenerate coefficient depending on the fractional order. Using a sub-grid correction method, we correct the basis functions in a natural weighted Sobolev space and show that these corrections are able to be truncated to design a computationally efficient scheme with optimal convergence rates. We further show that we can obtain a greater rate of convergence for sufficient smooth forces, and utilizing a global projection on the critical boundary. We present some numerical examples, utilizing our projective quasi-interpolation in dimension 2+1 for analytic and heterogeneous cases to demonstrate the rates and effectiveness of the method. (This is joint work with Donald L. Brown and Daniel Peterseim.)

Speaker's Bio:

Joscha Gedicke is a Postdoc at University of Vienna in the Department of Mathematics. His research interest is the numerical analysis of partial differential equations, in particular the analysis of (adaptive) finite element methods. He received his PhD degree from the Department of Mathematics at Humboldt University of Berlin in 2013. After that he joint the Departments of Mathematics and CCT at LSU as a Postdoc from 2013 to 2015 funded by a DAAD fellowship. After that he moved to the University of Heidelberg for one year before starting his current position at University of Vienna in 2016.

This lecture has refreshments @ 03:00 pm

Center for Computation & Technology
2003 Digital Media Center • Telephone: +1 225/578-5890 • Fax: +1 225/578-8957