Department of Mathematics

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Scientific Computing Seminar

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Monotone finite volume discretization of the diffusion and convection-diffusion equations on polyhedral meshes

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3:00 PM- 4:00 PM
Room 646 PGH

Abstract: We consider the cell-centered finite volume discretization of the steady diffusion and convection-diffusion equations [1,2]. The diffusion tensor may be heterogeneous, full and essentially anisotropic. The convection-diffusion operator may have the dominated convection part. The conformal computational mesh is assumed to consist of convex polyhedral cells. The conerstone of the method is the nonlinear two-point discretization of diffusion and advection fluxes derived on faces of mesh cells. The proposed finite volume method is monotone, i.e. it preserves non-negativity of the differential solution. The method is the 3D extension of the 2D finite volume discretizations [3,4].

[1]. Danilov A., Vassilevski Yu. A monotone nonlinear finite volume method for diffusion equations on conformal polyhedral meshes. Russian J. Numer. Anal. Math. Modelling, 2009, 24: 207-227.
[2]. Nikitin K., Vassilevski Yu. A monotone nonlinear finite volume method for advectiondiffusion equations on unstructured polyhedral meshes in 3D. Russian J. Numer. Anal. Math. Modelling, 2010, 25: 335-358.
[3]. Lipnikov K., Svyatskiy D., Vassilevski Yu. Interpolation-free monotone finite volume method for diffusion equations on polygonal meshes. J.Comp.Phys., 2009, 228: 703-716.
[4]. Lipnikov K., Svyatskiy D., Vassilevski Yu. A monotone finite volume method for advection-diffusion equations on unstructured polygonal meshes. J.Comp.Phys., 2010, 229: 4017-4032.