1136-65-397 **Shuonan Wu***, 316 McAllister Building, University Pk, PA 16802. *Simplex-averaged Finite Element Methods for General Convection-diffusion Problems.*

In this talk, we construct and analyze a finite element approximation for the $H(D)$ convection-diffusion problem where D can be chosen as grad, curl or div in 3D case. An essential feature of this construction is to properly average the PDE coefficients on the sub-simplexes. The scheme is of the class of exponentially fitted method that results in a special upwinding scheme when the diffusion coefficient approaches to zero. The well-posedness is established for sufficiently small mesh size assuming that the convection-diffusion problem is uniquely solvable. Convergence of first order is derived under minimal smoothness of the solution. Some numerical examples are given to demonstrate its robustness and effectiveness for general convection-diffusion problems. (Received January 20, 2018)