1148-65-7 **Rebecca Conley***, rconley@saintpeters.edu, and **Tristan J Delaney** and **Xiangmin Jiao**.
High-Order AES-FEM with High-Order Mesh Reconstruction. Preliminary report.

It is well known that meshing requirements can make achieving high-order accuracy with the finite element methods (FEM) challenging, especially when solving a PDE on a curved domain. We present a high-order method in conjunction with high-order mesh reconstruction, thus allowing the input mesh to be linear.

The Adaptive Extended Stencil Finite Element Method (or AES-FEM) is a generalization of the finite element method, which replaces the traditional basis functions with generalized Lagrange polynomial basis functions. These basis functions are computed using weight least squares, making AES-FEM insensitive to mesh quality. By combining AES-FEM with WALF (weighted average of least squares fittings) high-order surface reconstruction, we can achieve high-order accuracy with a linear input mesh. Numerical results demonstrate the high-order convergence of AES-FEM for 2D and 3D elliptic PDEs with Neumann and Dirichlet boundary conditions. (Received September 12, 2018)