1125-VC-1992 **Rebecca C Conley*** (rconley@saintpeters.edu), 121 Glenwood Ave, Loyola Hall Room 25, Jersey City, NJ 07306, and **Tristan J Delaney** and **Xiangmin Jiao**. *High-Order Adaptive Extended Stencil Finite Element Method (AES-FEM) on Tangled Meshes.* Preliminary report.

The finite element methods (FEM) are widely used for solving partial differential equations, but they are severely dependent on element quality. Additionally, they can fail if the mesh is tangled, that is, any of the elements are inverted (i.e. the Jacobian is negative). Adaptive Extended Stencil Finite Element Method (AES-FEM) is a generalization of FEM, which is insensitive to mesh quality. We propose an extension of AES-FEM that is stable on tangled meshes. AES-FEM achieves this by replacing the traditional basis function (hat functions) with generalized Lagrange polynomial basis functions, which are computed using weighed least squares. Numerical results demonstrate that AES-FEM improves the accuracy and stability of traditional FEM for 2D and 3D elliptic PDEs and a linear elasticity problem. (Received September 19, 2016)