Introduction
• Understanding the effects of fibrillated microstructure of UHMWPE fibers on perforation performance is critical for advancing ballistic protection systems
• Effects of cross-linked molecules are on the microscale and not accessible with a continuum FE model
• Rate dependent progressive composite damage model MAT162 in LS-Dyna is the state-of-the-art for ballistic penetration and perforation modeling
• Meshing fibers with hexagons will yield better simulation result compared to LS-Dyna’s default 4-noded elements (rectangles)

Objective
• Develop a computational framework to hexagonally mesh a 2D surface
• Visualize mesh for easy selection
• Once hex mesh is applied, disturb vertices to generate realistic model
• Write positions of nodes to LS-PrePost

Problem Specification
• Continuum FE models do not account for effects of important micromechanics of UHMWPE fibers
• Existing lattice generation software are not specific for LS-Dyna

Modeling Methodology
• Creating a user interface to upload 2D geometry and tile hexagons of a specified radius
• Detect which hexagons to use to model the geometry
• Write the selected hexagons to a LS-PrePost model.
• Extrude 2D cross-section to 3D fiber in LS-PrePost

Results and Discussion
• Graphical User Interface offers visual output for reviewing the mesh before applying nodes
• 2D geometry can be uploaded and tiled with hexagons of desired radius

Summary and Conclusion
• Graphical User Interface has been developed
• Ability to tile any 2D geometry with an explicit boundary with regular hexagons of desired radius has been achieved

Future Work
• Edit element geometry at edges to match supplied cross-section boundary
• Disrupt vertices stochastically to make model more realistic (Figs. 1 and 2)
• Clear previous canvas to be left with hexagons within the boundary
• Run ballistic simulations on unidirectional composites with microscale fibers

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References