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Computational Analysis of Low Reynolds Number Couette Flow Over Embedded Cavities[1] CHASE LEIBENGUTH, AMY LANG, WILL SCHREIBER, University of Alabama — Bio-inspired surface patterning research has shown the potential drag reduction qualities of micro-geometric embedded cavities placed on the surface of an object, analogous to the spaces formed between successive rows of scales on a butterfly wing. Vortices form inside the cavities and contribute to a net partial slip condition that interacts with the boundary layer over the surface. The interaction potentially affects the global flow field over an object to delay separation and reduce drag. In the present study, embedded cavity geometry in a Couette flow was modeled in GAMBIT and analyzed with FLUENT to qualitatively determine the cavity's drag reduction capabilities and the presence of a partial slip condition. The GAMBIT models consisted of a top plate moving transversally over a single cavity with periodic boundary conditions, differing rectangular geometry configurations, and varied gap heights. FLUENT was used to analyze the flow over a range of Reynolds Numbers from 0.01 to 100. Data was obtained to analyze cavity vortex formation, pressure and shear distributions inside the cavity, and the velocity distribution near the cavity.

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