Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

A Multiscale FSI Analysis of Flow past a Cylinder JAMES CHEN, MAURIN LOPEZ, Penn State Altoona — Micropolar fluid theory generalizes classical continuum mechanics by incorporating the microscale spinning effects of fluid molecules. It has been seen that Micropolar fluid theory shows strong promises of predicting the microscale fluid behaviours in the continuum level. With the two-level motion in Micropolar theory, the interaction between macromotion and micromotion in the fluid flows can be utilized to interpret flow phenomena. It is understood that the classical fluid theory is not fully capable of explaining fluids phenomena involving energy dissipation across multiple length scales from theoretical perspective. Such phenomena include vortex formation, boundary layer development and etc. Flow past a cylinder is studied as an example. An in-house developed solver based in a high order spectral difference method to solve the Micropolar equations with moving and deformable grids for fluid-solid interaction (FSI) is used. By studying how the translational velocity (macromotion) dissipates into gyration (micromotion) it is possible to understand how the energy cascade into smaller scales for vortex formation, this mechanism explains how vortices form and how the coherent structures of vortices and eddies construct.

James Chen
Penn State Altoona

Date submitted: 23 Jul 2014 Electronic form version 1.4