Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Model Order Reduction for the Coupled System of Flow and Moving Structure[1] HAOTIAN GAO, MINGJUN WEI, New Mexico State University — Traditional POD-Galerkin projection, as a popular approach for model reduction, is applied in a fixed fluid domain which, however, is not the case for many fluid-solid systems with moving objects/boundaries. Instead of treating a time-dependent fluid domain, we consider the combination of fluid and solid one single stationary domain. The idea, which is similar to immersed boundary technique used in numerical simulation, is having original Navier-Stokes equation in the combined and fixed fluid-solid domain and adding extra body-force terms to the equation only in solid area to represent the moving boundary or solid structure. Global POD modes can then be achieved with a special inner product also defined in the combined domain. With both the modes and equations defined in a fixed fluid-solid domain, the Galerkin projection is applied directly in the same domain and provides a global reduced-order model for the system. In comparison to the traditional approach, the new global model ends up with extra terms to represent solid motion and our preliminary results have shown that these terms are critical in sustaining system energy.

[1]Supported by ARL

Mingjun Wei
New Mexico State University

Date submitted: 30 Jul 2013 Electronic form version 1.4