Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

Experimental study of a vortex ring impacting a smart material-based cantilevered plate SEAN PETERSON, University of Waterloo, MAURIZIO PORFIRI, Polytechnic Institute of New York University — Recent developments in lightweight smart materials have generated scientific and technological advancements in small scale energy harvesting for powering low-consumption electronic devices. Often, energy is harvested from base excitation of a cantilevered smart material strip. In this case, the encompassing fluid acts as a passive damper, reducing the vibration amplitude and frequency, which reduces the harvesting capacity. By comparison, relatively few research efforts to date have explored the feasibility of using smart materials for harvesting energy directly from fluid motion. In this paper we employ vortex rings as the source from which to extract energy and use an ionic polymer metal composite (IPMC) strip in a cantilevered configuration as the harvesting device. Vortex rings, generated using a piston/cylinder arrangement submersed in water, are fired at the IPMC harvester and the resulting impact is recorded using a high speed video camera. The vortex ring propagation and circulation are estimated using flow visualization and particle image velocimetry. The plate deflection and electrical output are recorded as functions of time and correlated to the vortex strength and geometry.

Sean Peterson
University of Waterloo

Date submitted: 04 Aug 2011 Electronic form version 1.4