Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Application of Biot-Savart Solver to Predict Axis Switching Phenomena in Finite-Span Vortices Expelled from a Synthetic Jet[1] JOSEPH STRACCIA, JOHN FARNSWORTH, University of Colorado, Boulder — The Biot-Savart law is a simple yet powerful inviscid and incompressible relationship between the velocity induced at a point and the circulation, orientation and distance of separation of a vortex line. The authors have developed an algorithm for obtaining numerical solutions of the Biot-Savart relationship to predict the self-induced velocity on a vortex line of arbitrary shape. In this work the Biot-Savart solver was used to predict the self-induced propagation of non-circular, finite-span vortex rings expelled from synthetic jets with rectangular orifices of varying aspect ratios. The solver's prediction of the time varying shape of the vortex ring and frequency of axis switching was then compared with Particle Image Velocimetry (PIV) data from a synthetic jet expelled into a quiescent flow i.e. zero cross flow condition. Conclusions about the effectiveness and limitations of this simple, inviscid relationship are drawn from this experimental data.

[1]This material is based upon work supported by the National Science Foundation Graduate Research Fellowship under Grant No. DGE 1144083.

Joseph Straccia
University of Colorado, Boulder

Date submitted: 26 Jul 2016 Electronic form version 1.4