Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Critical point identification in 3D velocity fields.[1] MOHAMMADREZA ZHARFA, PAUL S. KRUEGER, Southern Methodist University — Classification of flow fields involving strong vortices such as those from bluff body wakes and animal locomotion can provide important insight to their hydrodynamic behavior. Previous work has successfully classified 2D flow fields based on critical points of the velocity field and the structure of an associated weighted graph using the critical points as vertices. The present work focuses on extension of this approach to 3D flows. To this end, we have used the Gauss-Bonnet theorem to find critical points and their indices in 3D vector field, which functions similarly to the Poincare-Bendixson theorem in 2D flow fields. The approach utilizes an initial search for critical points based on local flow field direction, and the Gauss-Bonnet theorem is used to refine the location of critical points by dividing the volume integral from of the Guass-Bonnet theorem into smaller regions. To verify this approach, we have applied this method on some flow fields generated from potential flow theory and numerical methods.

[1]This material is based upon work supported by the National Science Foundation under Grant No. 1557698

Mohammadreza Zharfa
Southern Methodist University

Date submitted: 26 Jul 2019 Electronic form version 1.4