LAGRANGIAN COHERENT STRUCTURES AND BIOLOCOMOTION

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We present some recent advances in the theory and implementation of Lagrangian coherent structures as well as their application to biological locomotion. The talk is based on joint work with Shawn Shadden, Francois Lekien and John Dabiri and others. In particular, this talk may provide useful background for the talk of Dabiri.

We begin with a review of the theory behind Lagrangian coherent structures (LCS) in 2 and 3 dimensions as well as recent advances in implementation and applications to ocean and atmospheric dynamics (see, for example, Haller [1],[2], and Shadden, Lekien, and Marsden [3]). Recent progress in implementing LCS in 3 dimensions will be presented.

Secondly, following Shadden, Marsden and Dabiri [4], we describe how LCS can be used to gain insight into both the problem of giving a well defined boundary to a vortex ring as well as the process of the entraining and detraining of fluid from it. In addition, we demonstrate how these techniques can give insight into the way feeding and locomotion are traded off in the swimming of jellyfish.

Finally, we show how LCS can also give information about the fluid dynamics of pulsatile jets and in particular, the structure of the vortex rings produced by these devices.

References

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