FLUIDS & THERMAL SCIENCES
Seminar

"Handling flows, the science of flying"

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3:00 p.m.
B&H Room 190

Abstract:

Bird flight and fish swimming are fascinating examples of moving (and deforming) bodies interacting with a fluid. By flapping its wings or fins, the animal imparts momentum to the surrounding flow and creates a jet which in turn propels it forward. Those body/fluid couplings are complex owing to the unsteady nature of the flows involved and a better understanding offers promising routes for man-made propellers.

The first part of my talk will focus on how flapping flight is affected by the structural properties of the wings, and in particular its flexibility. Bird or insect wings are elastic and thus likely to experiment large bending in flight, but the impact of such flexibility is an open and complex question. Using a mechanical replica of an insect, I will show that wing passive deformations can significantly improve propulsive performance when exploited in a constructive way.

In a second part, I will discuss how the locomotion of an individual is affected by the flows produced by neighbors. Using physical experiments that mimic the movements of fins or wings, I discovered that flapping bodies not only swim or fly faster when grouped together but that the flows also organize the group into ordered patterns with specific spacings. These findings suggest an intriguing analogy between animal groups and states of matter, in that a school might be viewed as a 'swimming crystal' of fish organized by flows.

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