**Aperiodicity and Chaos in Flapping Flight**

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**ABSTRACT**: Natural flyers like birds and insects flap their wings periodically to generate the aerodynamic loads required to fly. A variety of wake patterns in the trail of flapping wings holds the key to the interpretation of the aerodynamic loads. Normally, periodic flapping generates strictly periodic wakes but recent studies report a range of periodic flapping parameters that can lead to chaos in the flow-field. Chaos is highly undesirable from the viewpoint of flapping and presents an important practical problem. We look into the mechanism behind this chaotic transition, essentially to identify the complex flow-physics of what goes behind the transition in terms of the mutual interactions of the vortices. The global bifurcation routes to chaos for different flapping mechanisms are discussed in this context and the transitional dynamics are established conclusively. The effect of added complexities like flexibility and input stochastic gust are also discussed. Stochastic noise is seen to affect the overall dynamics strongly and new qualitative states are seen to emerge in the presence of input noise.

**Biography**

Sunetra Sarkar is a Professor at the Department of Aerospace Engineering, Indian Institute of Technology (IIT) Madras, India. She joined IIT Madras in 2007 as an Assistant Professor. She obtained her Ph.D. from Indian Institute of Science, Bangalore in 2005. Before joining IIT Madras, she has worked at the Faculty of Aerospace Engineering, Technical University of Delft, Netherlands as a Post Doctoral Fellow during 2005-2006. She was a NWO Rubicon fellow in The Netherlands during 2006-2007. She was a visiting scientist in the Department of Applied Mathematics, Chalmers University, Sweden in 2010. She had won the prestigious Amelia Earhardt fellowship award for women scientists in Aerospace Sciences & Engineering in 2001. Her broad research interests include, unsteady aerodynamics, nonlinear dynamics, fluid structure and acoustic-structure interactions and stochastic uncertainty quantifications. Her present projects are in the areas of flow induced oscillation based energy harvesting, stochastic modeling of unsteady flow past fins, fluid structure interaction of flapping wings and noise induced dynamics of bluff-bodies in cross-flow.

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