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3D Reconstruction and Visualization of a Hovering Dragonfly

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8:40 AM - DESS09-0109

Wing-Wake Interactions in Dragonfly Tandem Wings

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Bilateral and ipsilateral wing-wing interactions can be commonly observed in insect flights. As a representative example of ipsilateral wing-wing interaction, dragonflies in flight have been widely studied. An important fact is that the flow over their hindwings is affected by the presence of the forewings. Wake capture and phase-change play very important role on aerodynamic performance of the hindwings. In the current study, the high fidelity direct numerical simulations (DNS) of dragonfly tandem wings are employed to capture flow field and vortex structures and understand aerodynamics performances. Proper orthogonal decomposition (POD) analysis is then used to obtain low dimensional dynamic models, by which the most energetic modes are extracted. Furthermore, this approach is very efficient in the sense that it uses the smallest possible number of parameters and thus is suited for optimization and control in the future flapping-wing MAV design.

9:00 AM - DESS09-0100

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Reconstruction, simulation and visualization of insect flight is of great importance for the design of smaller and more efficient micro air vehicles (MAVs). To that end we are working on reconstructing the flapping wing motion of several quad wing insects based on the images taken from three high-speed cameras. The segmentation, point tracking and solid modeling methods used to automate the precise 3D reconstruction of a male blue dasher dragonfly as it takes off and begins to hover will be presented along with new flow visualization techniques designed to highlight the vortices being shed from the flapping wings.