Project title: Acoustic signature of low Reynolds number flapping wings

Advisor: Professor Daniel J. Bodony

Project description: The use of micro air vehicles (MAVs) for intelligence, surveillance, and reconnaissance in urban environments is being pursued by a number of Department of Defense agencies in the United States and elsewhere. For these vehicles to be effective, however, they must minimize their audible signature to avoid detection, as well as to increase the signal-to-noise ratio of any onboard acoustic sensors. Moreover, knowledge of the characteristic sound fields of MAVs makes possible the development of MAV detection arrays for defensive procedures.

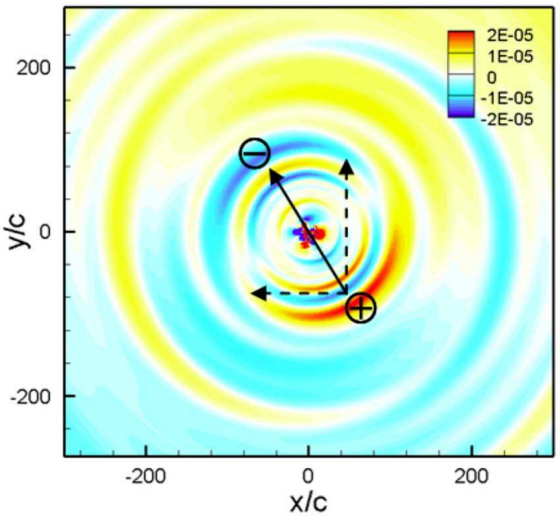

Figure 1: Example of sound radiation from a 2-D flapping wing. From Bae & Moon, *J. Acoust. Soc. Am.*, 2004.

The primary objective of this project is to develop a simplified model to estimate the unsteady lift and drag forces of a flapping airfoil when given the motion kinematics. These data will then be used to estimate the radiated sound using a well known aeroacoustic theory. If time permits simulations of the fully compressible Navier-Stokes equations will be conducted of the same wing motion for comparison with the model predictions.

Student background and expected research activites: The successful student should have a background in incompressible aerodynamics and understand how lift and drag are related to airfoil properties. Students with a background in unsteady aerodynamics are especially encouraged. A background in Matlab (or similar) computing environment is essential as the model predictions will be conducted numerically.

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