Adjoint-based optimization for flapping wings[1] MIN XU, MINGJUN
WEI, New Mexico State University — Adjoint-based methods show great poten-
tial in flow control and optimization of complex problems with high- or infinite-
dimensional control space. It is attractive to solve an adjoint problem to understand
the complex effects from multiple control parameters to a few performance indicators
of the flight of birds or insects. However, the traditional approach to formulate the
adjoint problem becomes either impossible or too complex when arbitrary moving
boundary (e.g. flapping wings) and its perturbation is considered. Here, we use
non-cylindrical calculus to define the perturbation. So that, a simple adjoint system
can be derived directly in the inertial coordinate. The approach is first applied to
the optimization of cylinder oscillation and later to flapping wings.

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