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A strong-coupling approach to simulate flexible flapping wing[1]
MINGJUN WEI, TAO YANG, New Mexico State University, HONG ZHAO, University of Illinois at Urbana-Champaign — An immersed boundary technique with strong-coupling flow-structure-interaction (FSI) is used to study the flapping and twisting of a two-dimensional flexible wing. Using the method by Zhao et al. (J. Comput. Phys., 2008), a single set of equations of motion on a fixed Eulerian mesh is solved for both fluid and solid. The solid characteristics is essentially presented as an extra elastic-stress term, which is distributed from an overlapping Lagrangian mesh for tracking the solid deformation and computing the stress. In this study, the moving trajectory is controlled by two means: 1) bodyforce term defined by traditional direct-forcing method to prescribe certain control points (e.g. pin or shake the leading edge); 2) external bodyforce term with certain frequency to push/pitch the wing. The rest of the wing kinematics and corresponding flow field is computed through FSI. Results for wings at different pitching frequencies are shown for the flow at Re=400.

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Mingjun Wei
New Mexico State University

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