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Fluid Forces and Vortex Wakes of a Flapping Foil TEIS SCHNIPPER, ANDERS ANDERSEN, TOMAS BOHR, Department of Physics and Center for Fluid Dynamics, Technical University of Denmark, JENS HONORÉ WALTHER, Department of Mechanical Engineering, Technical University of Denmark and Swiss Federal Institute of Technology Zurich, Chair of Computational Science — We present a combined numerical (particle vortex method) and experimental (soap film tunnel) study of a symmetric foil with pitching oscillations in a two-dimensional free stream. We vary the frequency and amplitude of the oscillations and observe von Kármán wake, inverted von Kármán wake, and wakes in which two vortex pairs form per oscillation period. We find a close correspondence between the numerically determined vortex structures and the thickness variations that visualize the flow in the soap film.[1] Numerically we obtain systematic maps with 25×40 simulations in the frequency and amplitude plane of both wake type and average forces and moments, and we discuss the drag-thrust transition in relation to the changes in wake structure. Finally, we investigate the time evolution of the fluid forces and its link to the vortex formation near the round leading edge and the vortex shedding at the sharp trailing edge.

[1]Schnipper, Andersen, and Bohr, J. Fluid Mech. **633**, 411–423 (2009).

Teis Schnipper
Department of Physics and Center for Fluid Dynamics,
Technical University of Denmark

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