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Fluid-structure interaction of oscillating flow in flexible vessels SEBASTIAN BURGMANN, SEBASTIAN GROßE, WOLFGANG SCHRÖDER, Institute of Aerodynamics, RWTH Aachen University, Germany — The flow field and the wall-shear stress in the respiratory and vascular system are known to be influenced by the flexibility of the walls. Up to now, most experimental biofluidic investigations have been performed in rigid models. In the present work the oscillating flow in a straight vessel with flexible walls is investigated. The model's fluid-mechanical parameters, i.e., the Reynolds and Womersley number, and structure-mechanical characteristics of the flexible wall, i.e., the Young's modulus and the material compliance, represent realistic blood flow in medium blood vessels. High-speed PIV measurements of oscillating water/glycerine flow in elastic vessels at Reynolds numbers based on the non-dilated vessel diameter D and peak velocities Re_D range from 1,000 to 1,750. The Womersley number α has been set to 5-15. The measurements are performed using a refractive-index adapted PIV system. The evolution of the unsteady flow field and the dilation of the flexible wall at the different combinations of Reynolds and Womersley numbers will be discussed. Furthermore, findings for the unsteady development of the wall-shear stress will be elucidated. The results are juxtaposed to Womersley's analytic solution and to experimental results of oscillating flow in rigid pipes.

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