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Fluid-Structure Interactions in Bristled Insect Wings MATTEO PEZZULLA, FRANCOIS GALLAIRE, PEDRO REIS, cole polytechnique fdrale de Lausanne — The wings of some small insects, such as the Mymaridae (fairyfly), comprise an unconventional porous structure with bristles emanating from an inner core. Despite the relatively large porosity of this structural layout, the wing can generate sufficient lift to enable a rich flight dynamics. The presence of the bristles seems to be a key element in the clap and fling flight dynamics at low-to-moderate Reynolds numbers, due to a non-trivial coupling between the deformation of the bristles, and the low-to-moderate Reynolds number flow, which can make a largely porous wing behave as an impervious one. Here, we study the morphology of bristled wings to rationalize the influence of their geometrical and mechanical properties on the interactions with the surrounding fluid. Specifically, we make use of micro-fabrication techniques to manufacture deformable hairy strips, which are the simplest synthetic counterpart of bristled wings. Then, we perform a systematic exploration of the geometry of the bristle-arrangements to understand how a specific combination of porosity and permeability is optimized in insect flight. We hope that our findings can provide a better understanding of the morphology of insect wings, together with their interplay with the surrounding fluid.

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