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Dragonflies flight: Mechanical study of the wings

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Odonata (dragonfly and damselfly) exhibit impressive flight ability. They are able to perform many different maneuvers such as zigzag, linear motion back and forth, sharp turn, quick acceleration. These trajectories are the result of complex fluid-structure interactions. Wing morphology has a main role in this interaction as shown in previous studies.
Insect wings, including dragonfly wings, are heterogeneous structures composed of an elastic membrane and a network of veins that control the local stiffness of the wing.
The characteristics of these wings (size, geometry, vein pattern. . .) strongly vary within the different phylogenetic lineages. Currently, there are about 6500 species of Odonata distributed on all continents, except Antarctica. We aim at understanding the role of the different parameters and structures of the wings on the aerodynamic force production . One of our goals is to give a physical description of the relation between wing morphology and flight mode over the range of existing dragonflies species and from an evolutionary perspective, starting from early apparitions of the first Odonatoptera (super order that includes Odonata) in the early late Carboniferous.
In this work, we perform a comparative study of wings of different species with different living modes. We focus on wing characteristics such as the aspect ratio, the relative position of the nodus and the position of pterostigma and the distribution of veins and the corrugation they allow. A first step for this study is to have a common measurement for all our wings, to be able to perform a quantitative comparison. We have chosen for this to perform mechanical tests based on a shaker which allows to excite the wing at different frequencies.

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