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Flexibility increases lift on passive fluttering wings DANIEL TAM, TU Delft, JOHN BUSH, MIT — We examine the influence of flexibility on the side-to-side fluttering motion of passive wings settling under the influence of gravity. This effect is examined through an experimental investigation of deformable rectangular wings falling in a water tank. Our results demonstrate the existence of an optimal flexibility, for which flexible wings remain flying twice longer and hence settle twice slower compared to rigid wings of identical mass and geometry. Flow visualizations and measurements provide key insight to elucidate the role of flexibility in generating increased lift and wing circulation by shedding additional vorticity at the turning point. Theoretical scalings are derived from a reduced model of the flight dynamics in qualitative and quantitative agreement with experiments. These scalings rationalize the strong positive correlation between flexibility and time of flight.

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