Abstract Submitted
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Torsional spring is the optimal flexibility arrangement of a flapping wing NICK MOORE, Florida State University — While it is understood that flexibility can improve the propulsive performance of flapping wings and fins, the flexibility distribution leading to optimal performance has not been explored. Using 2D small-amplitude theory and a fast Chebyshev method, we examine how thrust depends on the chord-wise distribution of wing stiffness. Through numerical optimization, we find that focusing flexibility at the wing's front, e.g. through a torsional spring, maximizes thrust. A wing with an optimally chosen spring constant typically generates 36% more thrust than a wing of optimal uniform stiffness. These results may relate to material distributions found in nature, such as insect wings, and may apply to the design of biomimetic swimmers and flyers, such as ornithopters.

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