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Geometric design of the best performing auto-rotating wing YUCEN LIU, LIONEL VINCENT, EVA KANSO, Univ of Southern California — Many plants use gravity and aerodynamics to disperse their seeds away from the parent plant. Various seed designs result in different dispersal modes from gliding to auto-rotating. Here, we are interested in understanding the effect of geometric design of auto-rotating seedpods on their aerodynamic performance. As an experimentally tractable surrogate to real seedpods, we investigate auto-rotating paper wings of various shape designs. We compare these designs to a control case consisting of the canonical rectangular wing. Inspired by aerodynamics, we begin by considering the benefit of an elliptical planform, and test the effect of aspect ratio on flight range and descent angle. We find the elliptical planform improves the tumbling rate and the aspect ratio has a positive effect on the flight performance of the wings. We then test two families of more complex shapes: one of tapered planform and one of a planform with sharp tips. We look for an optimal flight performance while constraining either the mass or the maximum length and width of the wing. We find that wings with sharper tips and larger length have higher auto-rotation rates and improved performance. The results imply that both the planform and length of the wing contribute to the wings flight performance.

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