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Fanning the Optimal Breeze with an Abanico GRACE GOON, JOEL MARTHELOT, PEDRO REIS, Massachusetts Institute of Technology — Flexible hand-held fans, or abanicos, are universally employed as cooling devices that are both portable and sustainable. Their to and fro axial motion about one's hand generates an airflow that increases the evaporation rate near the skin and refreshes. We study this problem in the context of fluid-structure interaction, through precision model experiments. We first characterize the elastic properties of a number of commercially available fans and evaluate their aerodynamic performance in a custom built apparatus. The air velocity profile that results from the flapping motion of the fan is characterized for different driving conditions. We then fabricate our own analogue model fans that comprise a thin elastic plate, shaped as a circular section, with an underlying substructure of radial slats. A systematic variation of the geometric and elastic parameters, along with an exploration of the parameter space of the periodic driving motion (amplitude and frequency), allows us to establish optimal design and operational conditions for maximal output of the generated airflow, while minimizing the input power.

Pedro Reis
Massachusetts Institute of Technology

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