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Pressure distribution, thrust performance, and wake structure of a low-aspect ratio pitching panel[1] JAMES BUCHHOLZ, MELISSA GREEN, ALEXANDER SMITS, Princeton University — To understand the fluid dynamics of a biologically inspired unsteady low-aspect ratio propulsor, time-averaged thrust performance, unsteady pressure distributions, and wake structures have been measured. Experiments were performed on a rigid rectangular panel pitching in a uniform flow with aspect ratios ranging from 0.54 to 2.38. Peak efficiencies between 9% and 21% were measured within a Strouhal number range of 0.13 to 0.34. At peak efficiency conditions, a reverse von Kármán vortex street pattern was observed in the near wake. However, in contrast to two-dimensional wakes, the wake exhibits transverse growth and spanwise compression with increased downstream distance. At greater Strouhal numbers, the transverse growth increases, yielding a double jet structure. Wake models based on low Reynolds number visualizations explain this behavior. Time resolved measurements of the pressure distribution along the surface were conducted in order to gain insight into optimization of thrust production as well as the generation of wake vorticity.

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Alexander Smits
Princeton University

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