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Near wake features of a flying European Starling ADAM KIRCHHEFER, GREGORY KOPP, University Of Western Ontario, ROI GURKA, BenGurion University — A great deal of research focusing on flapping wings has been motivated by their high performance capabilities, especially in low Reynolds number configurations where static wing performance typically suffers. The approaches to studying flapping wings have taken different forms. One form has been the systematic investigation of the parameters that influence the relationship between flapping wings and their wake. The other form, and the approach used in the present work, is the investigation of flapping wings in nature. While the earliest work on the flapping wings of animals consists of observations of bird flight by Leonardo DaVinci, advances in technology have allowed for quantitative measurements of the wake. The near wake of a freely flying European starling has been measured using high speed, time-resolved, particle image velocimetry, simultaneously with high speed cameras which imaged the bird. These have been used to measure the near wake two-dimensional velocity field that can be associated with the bird's location and wing configuration in an avian wind tunnel. Time series of the velocities have been expressed as composite wake plots, which depict segments of the wing beat cycle for various spanwise locations in the wake. Measurements indicate that downwash is not produced during the upstroke, suggesting that the upstroke does not generate lift. As well, the wake velocities imply the presence of streamwise vortical structures, in addition to tip vortices. These two characteristics indicate similarities between the wake of a bird and the wake of a bat.

Roi Gurka
BenGurion University

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