Abstract Submitted
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Crossing the boundary: experimental investigation of water entry conditions of V-shaped wedges[1] TINGBEN XIAO, DANIEL YOHANN, LIONEL VINCENT, University of Southern California, SUNGHWAN JUNG, Virginia Tech, EVA KANSO, University of Southern California — Seabirds that plunge-dive at high speeds exhibit remarkable abilities to withstand and mitigate impact forces. To minimize these forces, diving birds streamline their shape at impact, entering water with their sharp beak first. Here, we investigate the impact forces on rigid V-shaped wedges crossing the air-water interface at high Weber numbers. We vary the impact velocity V by adjusting the height from which the wedge is dropped. Both a high-speed camera and a force transducer are used to characterize the impact. We found that the splash base and air cavity show little dependence on the impact velocity when rescaling by inertial time d/V, where d is the breadth of the wedge. The peak impact force occurs at time t_p smaller than the submersion time t_s such that the ratio t_p/t_s is almost constant for all wedges and impact velocities V. We also found that the maximum impact force, like drag force, scales as AV^2, where A is the cross-sectional area of the wedge. We then propose analytical models of the impact force and splash dynamics. The theoretical predictions agree well with our experimental results. We conclude by commenting on the relevance of these results to understanding the mechanics of diving seabirds.

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Tingben Xiao
University of Southern California

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