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Physical model of kitesurfing PAWEL ZIMOCH, ADAM PAXSON, EDWARD OBROPTA, TOM PELEG, SAM PARKER, A.E. HOSOI, Massachusetts Institute of Technology — Kitesurfing is a popular water sport, similar to windsurfing, utilizing a surfboard-like platform pulled by a large kite operated by the surfer. While the kite generates thrust that propels the surfer across the water, much like a traditional sail, it is also capable of generating vertical forces on the surfer, reducing the hydrodynamic lift generated by the surfboard required to support the surfer's weight. This in turn reduces drag acting on the surfboard, making sailing possible in winds lower than required by other sailing sports. We describe aerodynamic and hydrodynamic models for the forces acting on the kite and the surfboard, and couple them while considering the kite's position in space and the requirement for the kite to support its own weight. We then use these models to quantitatively characterize the significance of the vertical force component generated by the kite on sailing performance (the magnitude of achievable steady-state velocities and the range of headings, relative to the true wind direction, in which sailing is possible), and the degradation in sailing performance with decreasing wind speeds. Finally, we identify the areas of kite and surfboard design whose development could have the greatest impact on improving sailing performance in low wind conditions.

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