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Evaluating low order models for force prediction in high-amplitude gusts GINO PERROTTA, ANYA JONES, University of Maryland — The unsteady forces on a plunging wing were measured for high-amplitude transient motions. The plunging velocity paralleled the canonical sine-squared transverse gust profile, including cases with plunging velocities far greater than the free stream velocity. The ratio of plunging velocity to free stream velocity was varied from one-sixth to 24 which allowed for quantification and demonstration of the increasing error in typical force prediction models. Each velocity ratio was tested at multiple values of free stream velocity. All cases were tested with a free stream to wing incidence angle of zero degrees. Forces and moments were measured on the same rigid flat plate wing for all cases. Measured forces during the gust were compared to forces predicted by various models, and the error between them was quantified. The parameter space defining the sine-squared gust was then partitioned into regions of high accuracy for unsteady force prediction models such as potential flow, quasi-steady based on steady measurements, and indicial functions. This highlights the strengths and weaknesses of each model, and identifies gust conditions that are not adequately modeled by any of these tools.

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