Applications of Extreme Value Theory and Reduced-Order Modeling to Structural Dynamics Simulations of Jet Engine Rotors and Ground Vehicles

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Extreme value theory has been used for many decades to predict the probability of maximum or minimum values from sets of random observations. Classical examples include predicting maximum flood levels for rivers and minimum time to failure for fatigue tests. In this presentation, it is shown how extreme value theory has been used in combination with reduced-order modeling methods to predict the maximum vibration response of rotor blades in jet engines. An emphasis is placed on key developments in the last decade that have enabled more efficient prediction and better understanding of the structural dynamics of jet engine rotors, especially with respect to assessing and mitigating the harmful impact of random mistuning on blade stress increases and attendant high cycle fatigue. Some developments in system identification, damage detection, and design are also highlighted. Finally, emerging directions in simulating the structural dynamics of ground vehicles are discussed.

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