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Aeroelastic Stabilities Analysis of a Transonic Fan Rotor NASA Rotor67

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ABSTRACT

Blade flutter is a complex phenomenon that can lead to serious damage or failure of turbomachinery systems. Predicting and mitigating blade flutter is therefore an important aspect of the design and analysis of these systems[1]. In this paper, we present a comparative study of two representative methods for blade flutter predictions: the energy method and the computational fluid dynamics/computational structural dynamics (CFD/CSD) coupled time-domain method. The energy method is a decoupled approach that uses a simplified model of the blade and fluid-structure interaction to calculate the stability boundaries of the system[2]. The time-domain method, on the other hand, is a more detailed approach that simulates the unsteady flow and structural dynamics of the system in time[3]. To compare these methods, we apply them to NASA Rotor67 under various flow conditions and investigate their accuracy, computational efficiency, and ease of implementation. Our results show that the energy method is generally faster and simpler to use, but can be less accurate in certain situations. The time-domain method, on the other hand, provides more detailed and accurate predictions, but is computationally more expensive and requires more expertise to implement. Overall, our study suggests that the choice of method depends on the specific requirements and constraints of the application. Both methods have their advantages and limitations, and can be used together to provide complementary insights into the blade flutter behavior of turbomachinery systems.

KEYWORDS

Blade flutter; computational fluid dynamics (CFD); energy method; time-domain coupled method

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