ICCES, 2024, vol.30, no.2
DOI: 10.32604/icces.2024.012592

PROCEEDINGS

Investigation of Flutter Mechanism in Transonic Rotor Blades with Structural Damage via SPOD Method

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ABSTRACT

The persistence of accidents attributed to structural damage in traditional rotor blades remains a pressing concern for aeronautical experts. Given the infrequency of flutter in undamaged blades, this study directs its attention to a rotor blade afflicted with structural damage, with a primary objective of discerning flutter occurrences, elucidating underlying mechanisms, and scrutinizing resultant aeroelastic responses. This paper presents an investigation into the flutter mechanism observed in transonic rotor blades subjected to structural damage, employing the Spectral Proper Orthogonal Decomposition(SPOD) method. The study aims to understand the dynamics of flutter under the influence of structural damage, which is crucial for ensuring the safety and performance of rotor systems operating in transonic conditions. The SPOD method offers a systematic approach to analyze the modal characteristics of damaged rotor blades, enabling the identification of critical flutter modes and their interaction with structural anomalies. Insights gained from this investigation can contribute to the development of effective strategies for mitigating flutter and enhancing the structural integrity of transonic rotor blades.

KEYWORDS

Rotor blades; flutter mechanism; SPOD; structural damage

Acknowledgement: The authors gratefully acknowledge the technical support provided by the Multidisciplinary Flight Dynamics and Control Laboratory of the School of Astronautics, Northwestern Polytechnical University.

Funding Statement: This study was supported by the National Natural Science Foundation of China (11972294) and Projects of International (Regional) Cooperation and Exchanges NSFC(12211540709).

Conflicts of Interest: The authors declare that they have no conflicts of interest to report regarding the present study.