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Effect of engine location on flutter speed and frequency of a tapered viscoelastic wing

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The flutter of a tapered viscoelastic wing carrying an engine and subjected to a follower thrust force is investigated. The wing is considered as a cantilever tapered Euler-Bernoulli beam, made of a linear viscoelastic material where Kelvin-Voigt model is assumed to represent the viscoelastic behavior of the material. In addition, quasi-steady and unsteady aerodynamic forces models are introduced along with the follower thrust force. The mass and inertia of the engine are modeled in order to achieve more realistic behavior of the engine upon flutter characteristics of the system. Moreover, the governing equations of motion are derived through the Extended Hamilton's Principle. The generalized function theory is used to more accurately consider the contribution of the mass and its follower force in the governing equations. The resulting partial differential equations are solved by Galerkin method along with the classical flutter investigation approach. Parametric studies highlighting the sensitivity of the chord-wise engine location, the span-wise engine location, and the vertical engine location on the flutter speed and flutter frequency are reported. It is found that the location of the engine in the three directions play an important role in the dynamic stability of the wing.

Biography

Youssef S Matter has completed his BSc in Aerospace Engineering in 2014 from Khalifa University of Science, Technology and Research and currently pursuing his MSc in Mechanical Engineering at United Arab Emirates University. He is a Research Engineer at the Mechanical Engineering Department of UAE University.

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