Coupled Fluid Structure Flutter Analysis Of A Transonic Fan

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A coupled fluid-structure method is developed for flutter analysis of blade vibrations in turbomachinery. The approach is based on the time domain solution of the fluid-structure interaction in which the aerodynamic and structural equations are marched simultaneously in time.

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A COUPLED FLUID–STRUCTURE ANALYSIS FOR 3-D INVISCID ...

Current trends in turbomachinery design significantly reduce the mass ratio of structure to air, making them prone to flutter by aerodynamic coupling between mode shapes, also called coupled-mode flutter. The p-k method, which solves an aeroelastic eigenvalue problem for frequency and damping respectively excitation of the aerodynamically coupled system, was adapted for turbomachinery application using aerodynamic responses computed in the frequency domain.

Coupled Mode Flutter Analysis of Turbomachinery Blades ...

The fluid–structure configurations investigated in the following are entirely characterized by four non-dimensional parameters: (1) R e = U ∗ L ∗ / ν f ∗, M s = ρ s ∗ / ρ f ∗, E s = E s ∗ / (ρ f ∗ U ∗ 2) and ν s where the Reynolds number R e characterizes the fluid flow, the solid-to-fluid density ratio M s controls the strength of the inertia effects in the fluid–structure coupling, and the non-dimensional Young modulus E s and Poisson coefficient ν s ...

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Theoretical analysis indicates that the flutter dynamic pressure Q F and the flutter frequency f F at the point of mass similarity are finally evaluated as (9) Q F a = Q F m / N F (10) f F a = f F m / N F where the superscripts a and m refer to the actual vehicle and the computational model with decreased stiffness, respectively, and N F denotes the critical stiffness coefficient of flutter relative to the actual value.

Thermal flutter prediction at trajectory points of a ...

In fluid–structure problems one can argue, that a fluid domain deformation u(f) released through a boundary deformation u Γ (f) leads to a boundary force f Γ (f) and therefore a pseudo-structure formulation is introduced for the fluid problem: (13) F u Γ (f) = f Γ (f).

Application of Lagrange multipliers for coupled problems ...

Fluid–structure interaction is the interaction of some movable or deformable structure with an internal or surrounding fluid flow. Fluid–structure interactions can be stable or oscillatory. In oscillatory interactions, the strain induced in the solid structure causes it to move such that the source of strain is reduced, and the structure returns to its former state only for the process to repeat. Propagation of a pressure wave through an incompressible fluid in a flexible tube

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