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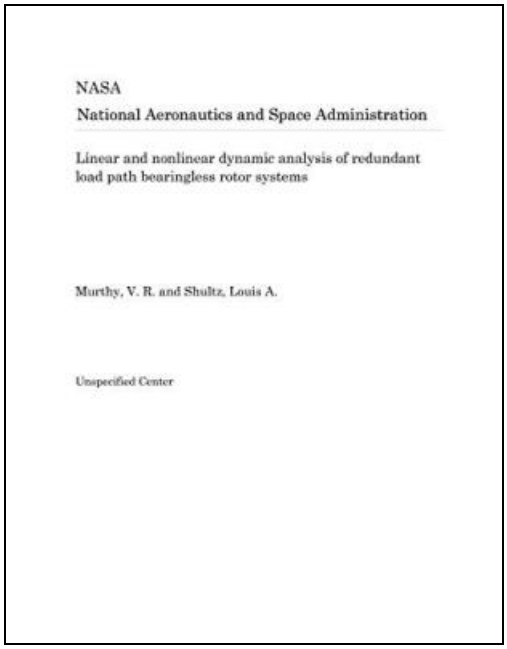
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Linear and nonlinear dynamic analysis of redundant load path bearingless rotor systems

Murthy, V. R. and Shultz, Louis A.

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Independently Published, United States, 2018. Paperback. Condition: New. Language: English. Brand new Book. The goal of this research is to develop the transfer matrix method to treat nonlinear autonomous boundary value problems with multiple branches. The application is the complete nonlinear aeroelastic analysis of multiple-branched rotor blades. Once the development is complete, it can be incorporated into the existing transfer matrix analyses. There are several difficulties to be overcome in reaching this objective. The conventional transfer matrix method is limited in that it is applicable only to linear branch chain-like structures, but consideration of multiple branch modeling is important for bearingless rotors. Also, hingeless and bearingless rotor blade dynamic characteristics (particularly their aeroelasticity problems) are inherently nonlinear. The nonlinear equations of motion and the multiple-branched boundary value problem are treated together using a direct transfer matrix method. First, the formulation is applied to a nonlinear single-branch blade to validate the nonlinear portion of the formulation. The nonlinear system of equations is iteratively solved using a form of Newton-Raphson iteration scheme developed for differential equations of continuous systems. The formulation is then applied to determine the nonlinear steady state trim and aeroelastic stability of a rotor blade in hover with two branches at the root. A comprehensive computer program is developed and is used to obtain numerical results for the (1) free vibration, (2) nonlinearly deformed steady state, (3) free vibration about the nonlinearly deformed steady state, and (4) aeroelastic stability tasks. The numerical results obtained by the present method agree with results from other methods. Murthy, V. R. and Shultz, Louis A. Unspecified Center AEROELASTICITY; BEARINGLESS ROTORS; BOUNDARY VALUE PROBLEMS; DYNAMIC STRUCTURAL ANALYSIS; MATRIX METHODS; NONLINEAR EQUATIONS; ROTOR DYNAMICS; DIFFERENTIAL EQUATIONS; EQUATIONS OF MOTION; FREE VIBRATION; HOVERING; NEWTON-RAPHSON METHOD; RESONANT FRE.

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