3D Blade Flutter of the Last Stage Steam Turbine

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Summary:

In this study, numerical simulations of 3D viscous and non-viscous flutter of the last stage steam turbine rotor blades were performed.
The developed numerical algorithm solves the 3D Reynolds-averaged Navier-Stokes equation together with Baldwin-Lomax, using the explicit monotonous second-order accurate Godunov-Kolgan finite-volume scheme and moving hybrid H-O structured grid. The structure analysis uses the modal approach and 3D finite element model of the blade. The blade motion is assumed to be a linear combination of modes shapes with the modal coefficients depending on time. The influence of the natural frequencies on the aerodynamic coefficient and aeroelastic coupled oscillations is shown.
The stability (instability) areas for the modes are obtained. It has been shown that interaction between modes plays an important role in the aeroelastic blade response. This interaction has essentially nonlinear character and leads to blade limit cycle oscillations.