FINITE ELEMENT MODEL UPDATING OF LARGE SCALE STEAM TURBINE ROTOR

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ABSTRACT –
This paper presents a computational framework for the updating of large scale finite element models. An extensible framework of CMA-ES optimization algorithm, a state of the art updating technique, was coupled with EPILYSIS solver, in order to produce computational effective results. The developed framework is applied to a high-fidelity FE model of a steam turbine rotor with several millions of degrees of freedom, using experimentally identified modal parameters. First, using an integrated reverse engineering strategy, the digital shape of the three sections of a steam turbine rotor were developed and the final parametric CAD model was created. The finite element model of the turbine was created using tetrahedral solid elements. Due to complex geometry of the structure, the developed model consists of about fifty-five million DOFs. The identification of modal characteristics of the frame is based on acceleration time histories, which are obtained through an experimental investigation of its dynamic response in a support-free state by imposing impulsive loading. The developed computational framework with appropriate substructuring methods, are used for estimating the parameters (material properties) of the finite element model, based on minimizing the deviations between the experimental and analytical modal characteristics. Direct comparison of the numerical and experimental data verified the reliability and accuracy of the methodology applied.