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Unsteady Interaction between a High-Pressure Turbine and a Counter-Rotating Low-Pressure Turbine FREDERIC FELTEN, GREGORY LASKOWSKI, GE Global Research — In an effort to strengthen our knowledge, understanding and prediction capabilities of unsteady turbine aerodynamics in multistage turbomachinery, an in-depth numerical analysis of a single stage High-Pressure Turbine (HPT) followed by a counter-rotating Low-Pressure Turbine (LPT) is performed via unsteady CFD using a parallel version of the RANS flow solver MSU-Turbo. Results from two numerical simulations are presented. Two HPT rotor design are being compared to each other and to available experimental data. The computational domains consist of the 1^{st} HPT rotor blade, the 1^{st} LPT nozzle, and the 1^{st} counter-rotating LPT rotor. In order to respect the circumferential blade count and the corresponding spatial periodicity, a $1/18^{th}$ of annulus is used for each blade row. Particular attention is given to the aerodynamic loss mechanism in the inter-turbine space. The inquiry focuses on the HPT rotor tail shock waves and their interaction with the LPT reflected shock. In addition, the investigation is extended to show how far downstream the interaction loss transfers to LPT components. Finally, an attempt is made to answer the following questions: 1)-Is the interaction loss reflected by time-averaged performance parameters? 2)- Is it carried by periodic waveforms? Or 3)- Is it represented by an increase of turbulence level?

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