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Investigating Effects of Cracked Blade under Various Rotor Speed on Aerodynamic Characteristics in 1.5 Stage GE-E3 Gas Turbine THANH DAM MAI, MYUNG GON CHOI, YUMIN KIM, JAIYOUNG RYU, Department of Mechanical Engineering, Chung Ang University, Seoul, 06974, Republic of Korea
— The variation in revolutions per minute (RPM) has significant effects on dynamic behaviors, the flow characteristics, and the heat transfer in gas turbine. Coupled with cracked blade conditions, it can be speculated to have more dramatic effects on the overall performance. This is the first study to address both RPM variation and cracked rotor blade condition in three-dimensional unsteady gas turbine simulation. Reynolds-averaged Navier-Stokes (RANS) equation is used with k- ω SST γ turbulence closure model to solve high-speed, high-pressure compressible flow in GE-E3 gas turbine. Numerical cases are selected with RPMs of 4000, 3600, 3200, and 2800 under same cracked blade conditions. As a result, average temperature and heat flux on the blade surface are found to have inverse relations with RPM. Pressure overshoot occurs at greater RPM changes, but significant drop in average temperature and heat flux is observed at 4000 RPM. Moreover, it is also found that crack condition has significant effects on the aerodynamic behavior of compressed gas in high pressure gas turbine.

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