

SPACE PROPULSION SYMPOSIUM (C4)
Joint Session on Nuclear Propulsion and Power (7-C3.5)

Author: Dr. Jiang Bin
Harbin Engineering University, China, jiangbin_hrbeu@163.com

THE NUMERICAL STUDY ON THE FLOW STRUCTURE AND LOSE MECHANISM WITHIN THE
TIP CLEARANCE OF A HELIUM COMPRESSOR CASCADE

Abstract

In this paper, the detailed flow features within the tip clearance of a compressor cascade was simulated numerically with the combination of SST turbulence model and γ -Re transition model to study the formation process of the tip leakage vortex and its impact on the local flow losses. Based on the simulation results, the effect of transition process which happened near the tip area to the tip leakage volume, leakage intensity and area of affected location was analyzed. Finally, the mechanism of how the property of helium can change the local lose near the tip area was concluded. From this study, there are two main conclusions. The first is that with the increase of tip clearance the interaction between the leakage vortex and passage vortex will become more intense. The second is with use of helium as the working fluid, the secondary flow structure within the tip area will be changed and the low Reynolds number cause by the property of helium will increase the local loses, the aerodynamic stability of the compressor cascade was undermined consequently.