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The Influence of Step and Fillet Shape on Nozzle Endwall Heat Transfer

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Abstract : There is a gap at combustor-turbine interface where leakage flow comes out to prevent hot gas ingestion into the gas turbine nozzle platform. The leakage flow protects the nozzle endwall surface from the hot gas coming from combustor exit. For controlling flow's stream, the gap's geometry is transformed by changing fillet radius size. During the operation, step configuration is occurred that was unintended between combustor-turbine platform interface caused by thermal expansion or mismatched assembly. In this study, CFD simulations were performed to investigate the effect of the fillet and step on heat transfer and film cooling effectiveness on the nozzle platform. The Reynolds-averaged Navier-stokes equation was solved with turbulence model, SST k-omega. With the fillet configuration, predicted film cooling effectiveness results indicated that fillet radius size influences to enhance film cooling effectiveness. Predicted film cooling effectiveness results at forward facing step configuration indicated that step height influences to enhance film cooling effectiveness. We suggested that designer change a combustor-turbine interface configuration which was varied by fillet radius size near endwall gap when there was a step at combustor-turbine interface. Gap shape was modified by increasing fillet radius size near nozzle endwall. Also, fillet radius and step height were interacted with the film cooling effectiveness and heat transfer on endwall surface.

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