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Computational Study of Film Cooling Performance of a Gas Turbine: An application of the Transverse Jets GERMAN SIERRA-VARGAS, CARLOS DUQUE-DAZA, Dept. of Mechanical and Mechatronics Engineering, Universidad Nacional de Colombia — Film cooling technology based on transverse jets is employed to provide and control a protective film that remains attached to the surface and therefore to reduce the heat transfer from a high temperature main flow to the surface to be protected. Aiming to assess the impact of the jet-to-crossflow velocity ratio on the film cooling effectiveness, a number of numerical experiments were performed using four jet-to-crossflow velocity ratios over a NACA 4412 cascade vane. A computational model based on finite volume discretization, employing a WALE turbulence model, was prescribed to solve an incompressible flow on a 3D structured mesh. A passive scalar was included in the model to simulate temperature and transport of energy. Y^+ values and Courant number were limited, in order to ensure convergence. Comparisons were made between the jet trajectory and the friction coefficient, evidencing how the mid-line of the cooling jet yields regions of boundary-layer separation and re-attachment. Analysis of the boundary-layer behavior indicates a relation with the local convective coefficient increments. Moreover, the results showed how the film cooling decreased the heat transfer at the region near the injection, but increased detrimentally the heat flux at the end of the vane.

German Sierra-Vargas
Dept. of Mech and Mechatronics Eng, Universidad Nacional de Colombia

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