Abstract

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INVESTIGATION OF A NOVEL DISCRETE SLOT FILM COOLING SCHEME

The future of the gas turbine industry is strongly relying on the development of new efficient cooling schemes. Film cooling is one popular and reliable cooling technique, one way to increase the film cooling effectiveness is through the use of shaped holes. In this paper two proposed shaped holes are being studied and compared thoroughly against the conventional round hole film cooling. The two proposed holes are based on the theoretically perfect continuous slot film cooling, however, these slots are not continuous, and preserves the solid surface to the total blade surface ratio. The first design to be studied is the Rectangular Divergent Slot, and the second is the Aeroslot, which is a discrete aerodynamically shaped slot both designs showed an increase in the centerline film cooling effectiveness when compared to the conventional round holes. The Aeroslot showed a large increase in film cooling effectiveness for the same blowing ratio, and mass flow rate of coolant, when compared to the other shapes. A sensitivity study of the blowing ratio to the centerline film cooling effectiveness is carried out for several blowing ratios, covering different jet in cross flow behaviors, fully attached jet, and detached-reattached jet.