HEAT TRANSFER AND FLOW FIELD INVESTIGATION IN RIB-ROUGHENED TRAILING EDGE CHANNEL WITH CROSSING JETS

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Nowadays continuous cooling of turbine blades allows the operating temperatures to exceed the materials' melting point without affecting the blade integrity. In order to achieve such a result the heat transfer coefficient has to be maximized, while minimizing the coolant flow rate.

The objective of the present research is to investigate the heat transfer and the flow field within a trailing edge internal cooling channel with crossing jets. Since the channel is rib-roughened, particular attention is devoted to investigate the combined effect of two phenomena: forced convection (provided by the ribs) and impingement (provided by the cross-over jets).

A scaled-up model of the channel has been designed and manufactured. It presents two rows of slots on two opposite sides. The coolant enters from one side, through the crossing jet slots, and exits on the opposite side, through the trailing edge slots.

The channel with and without ribs is characterized with respect to Reynolds number and pressure drop using pressure taps, Pitot tubes, and a hot wire. The flow field is investigated using surface flow visualization techniques: ink dots tracers and wool tufts.

The heat transfer coefficient on the bottom wall is investigated with and without ribs. For this purpose, the wall temperature is measured using thermocromic liquid crystals. A mixture of two types of crystals is used in order to increase the working range. An existing algorithm implemented in MATLAB is applied to detect the isothermal lines automatically. The averaged heat transfer is also evaluated on the rib surface.

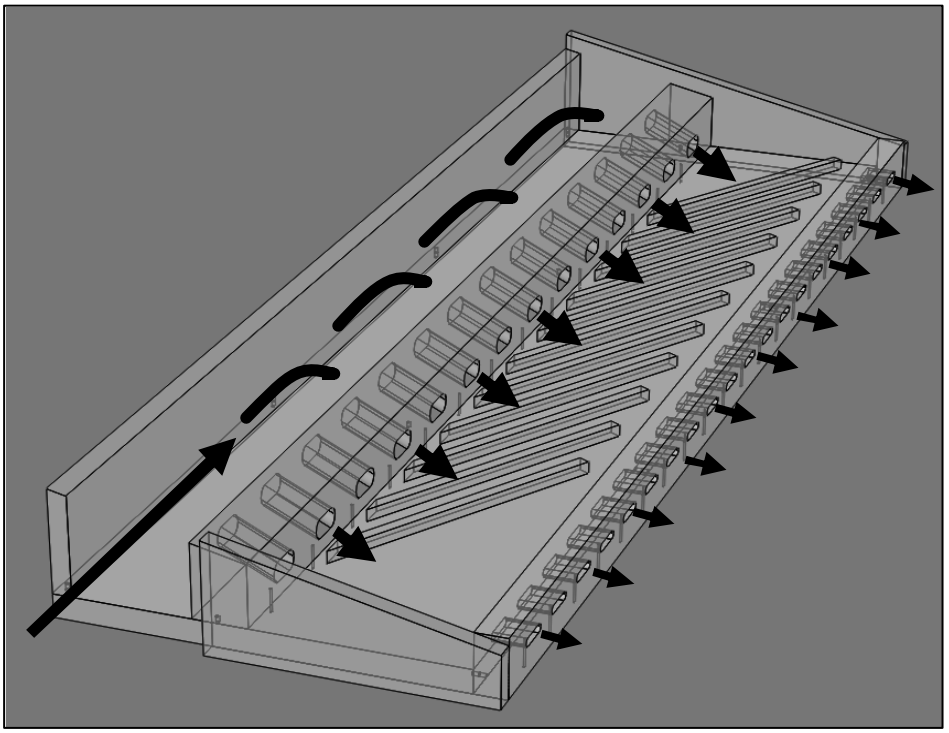

Figure 1: Test section