

ON THE VALIDITY OF TURBULENT HEAT FLUX SPECTRA IN AN IMPINGING FLOW CONDITION

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Measurements using a novel heat flux sensor were performed in an internal ribbed channel representing the internal cooling passages of a gas turbine blade. These measurements allowed for the characterization of heat transfer turbulence levels and unsteadiness not previously available for internal cooling channels. In the study of heat transfer, often the fluctuations can be equally as important as the mean values for understanding the heat loads in a system. In this study comparisons are made between the time-averaged values obtained using this sensor and detailed surface measurements using the transient thermal liquid crystal technique. The time-averaged heat flux sensor and transient TLC results showed very good agreement, validating both methods. Time-resolved measurements were also corroborated with hot film measurements at the wall at the location of the sensor to better clarify the influence of unsteadiness in the velocity field at the wall on fluctuations in the heat flux. These measurements resulted in turbulence intensities of the velocity and heat flux of about 20%. The velocity and heat flux integral length scales were about 60% and 35% of the channel width respectively, resulting in a turbulent Prandtl number of about 1.7 at the wall.