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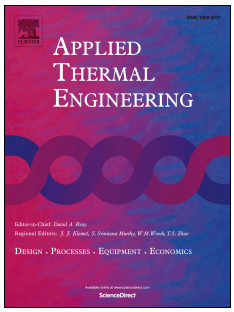

Numerical Investigation on the Flow and Heat Transfer in a Rotor-Stator Disc Cavity

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Abstract: This paper presents a numerical investigation on the flow and heat transfer characteristics in a rotor-stator disc cavity. The Reynolds-averaged Navier-Stokes equations, coupled with standard $k-\varepsilon$ turbulent model, are adopted and solved. Four different secondary air flow rates and five kinds of rotational Reynolds numbers have been examined to determine the effect on the flow and heat transfer. Some results obtained in this study indicate that the heat transfer coefficients increase with the increasing rotational Reynolds numbers except for some small radius region. The local Nusselt number could be correlated with the local rotational Reynolds number by power laws. The sealing effectiveness increases with the increasing secondary air flow rates and its decreasing drop at low flow rate decreases with the increase of rotational Reynolds numbers. The flow structure in the rotor-stator cavity does not remain unchanged and it could experience a transition from Batchelor-type to Stewartson-type outward along the radial direction. Pumping effect that the centrifugal forces in the boundary layer at the rotor surface drives the cavity fluid outward and induces the compensatory fluid at the stator surface flow inward. In final, a new fully-coupled heat transfer method has been firstly presented for a trial.