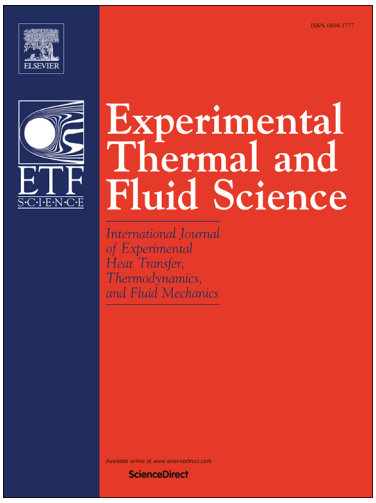

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PII: S0894-1777(18)30879-3
DOI: https://doi.org/10.1016/j.expthermflusci.2018.06.025
Reference: ETF 9521

To appear in: *Experimental Thermal and Fluid Science*

Received Date: 2 February 2018
Revised Date: 29 May 2018
Accepted Date: 26 June 2018

Please cite this article as: A. Nouri-Borujerdi, M.E. Nakhchi, Experimental Study of Convective Heat Transfer in the Entrance Region of an Annulus with an External Grooved Surface, *Experimental Thermal and Fluid Science* (2018), doi: https://doi.org/10.1016/j.expthermflusci.2018.06.025

Experimental Study of Convective Heat Transfer in the Entrance Region of an Annulus with an External Grooved Surface

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ABSTRACT

The aim of this experimental work is to study the effect of grooved surfaces in the entrance region of annular flows on local heat transfer. The outer stationary cylinder is grooved and the inner rotating cylinder is smooth. This configuration is applicable in industrial applications such as rotating heat pipes for cooling of superconducting machines or motors rotor, electrical generators where heat generates in the grooves containing wires, transient heating of axial compressor rotor drams, combustion chamber in turbojets, air-cooled axial-flux permanent-magnet machines. The experimental tests were performed based on aspect ratio of the groove, effective Reynolds number and Taylor number. It is observed that the dimensions of the groove, rotational speed as well as fluid axial velocity have significant effect on heat transfer rate. The present results show that the gradient of the averaged air temperature in the groove zone is larger than that in the gap between the two cylinders and temperature in this zone can be approached to the surface temperature if the channel length is long enough. In addition, a correlation for the local Nusselt number is proposed as a function of the effective Reynolds number, the groove aspect ratio and the local axial position from 270 experimental data. The correlation is capable to predict the local Nusselt number with a maximum error within 11% relative to the experimental data.

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