Proceedings of the 11th International Conference on Fluid Flow, Heat and Mass Transfer (FFHMT 2024)
Chestnut Conference Centre - University of Toronto, Toronto, Canada – June 16-18, 2024
Paper No. 047
DOI: 10.11159/ffhmt24.047

Unveiling the Flow Dynamics Spectrum: A Study of Corner Flow under No-Slip and Navier-Slip Condition

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Extended Abstract

In this study, we embark on a deep dive into the fascinating realm of laminar axial flow around a corner. Our investigation unfolds along two key axes: to scrutinize the intricate interplay between fluid dynamics and corner geometry, and to meticulously examine the impact of different boundary conditions (BCs) imposed at the fluid-solid interface.

We delve into two distinct BC scenarios: the ”strict” no-slip condition [1,2,4], which dictates a stringent constraint of zero velocity at the solid surface, and the more ”permissive” Navier’s slip condition [2,3,5], which accommodates a degree of fluid slippage along the boundary.

Of particular interest is the delicate transition between these two scales of boundary behavior. Actualized by examples

we show how a short distance theory smoothly becomes an effective at larger distances. Remarkably, we unveil a profound

analogy between the flow problem under investigation and the realm of stationary heat exchange. The heat exchange problem is one example of the possible application of our new method (combination of permitting BC and corner geometry) by use of one-one correspondence with a vast verity of natural problems [6-12], far beyond the confines of fluid dynamics.

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