Numerical simulation of the forced convective flow in a channel partially filled with an anisotropic porous medium

Ben Aoua Salah[1], Mechighel Farid*[2,3], and Kibboua Rachid[4]

[1]LR3MI Laboratory, Faculty of Technology, BP 12, University of Annaba, Algeria – Algérie
[2]LR3MI Laboratory, Faculty of Technology, BP 12, University of Annaba, Algeria – Algérie
[3]SPCTS Laboratory, University of Limoges, France (SPCTS) – SPCTS Laboratory – SPCTS Laboratory, University of Limoges, France, France
[4]University of Sciences and Technologies Houari Boumedien USTHB, LTPMP/FGMGP, BP 32 El Alia, Algiers, Algeria – Algérie

Résumé

A numerical study of a laminar stationary forced convection inside a flat horizontal channel partially filled with a porous medium has been carried out. The porous medium is assumed to be anisotropic and its walls are maintained at a constant heat flux. The Darcy-Brinkman-Forchheimer model is used to describe the flow in the porous medium. The governing equations of conservation of mass, momentum and energy, and the associated boundary conditions are solved using a numerical code based on the finite volume method. The objective of this work is to specify the nature of convective flows in anisotropic porous medium. The results highlighted the influence of the anisotropic permeability ratio K* (with K* in the range between 0.1 and 10), the anisotropy angle
theta (with
theta in the range 0 and 90∘), the dimensionless thickness E* of the porous layer (between 0 and 1), the Darcy number Da (with Da in the range between 10-4 and 10-1), and the thermal conductivity ratio Rc (Rc = 1 and Rc = 10) on both the Nusselt number and the pressure drop.

*Intervenant