

Numerical Simulation of Natural Convection in a Vertical Channel with irregular walls

Mohammed Hasnat¹, Abdellah Bekacem², Kouari Mustapha³, Noureddine Kaid⁴,
Belkacem Draoui⁵

^{1,2,3,4,5}Laboratory of energy in arid areas (ENERGARID), Faculty of Science and Technology, University of
BECHAR, BP 417, 08000 BECHAR.

First author email: mohammed.hasnat@yahoo.fr

ABSTRACT: A general method is presented for convection-diffusion problems. This method is called CVFEM, formulated for two-dimensional problems, but its key ideas may be extended to three dimensions. The computational domain is first divided into triangular elements with three nodes, and then polygonal control volumes are constructed by joining the centroids of the elements to their corresponding sides' media. This method uses the interpolation equal order velocity-pressure to the resolution of the Navier-Stokes equations. A procedure called "Mass-Weighted Upwind" is presented and applied to the estimation and calculation of convective terms, this procedure has proven its effectiveness in convective flow problems, which large variations are in both module and direction. Resolution procedure "SIVA" is used to solve the nonlinear coupling of all discretized equations.

This numerical method is applied to the laminar flow problems in natural convection in a vertical channel heated symmetrically; one case is for a single obstruction, the other case with two walls ribs. The thermal boundaries conditions used are uniform wall temperature (UWT). The profiles of the average Nusselt number are presented for all the cases studied. FORTRAN code is elaborated in this paper.

KEYWORDS: *Natural convection method CVFEM, Mass-Weighted Upwind, SIVA, Complex geometry, Laminar flow volume*
