A Numerical and Experimental Analysis on Confined Impinging Round Jets in Porous Media

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A possible solution to obtain efficient cooling systems is represented by the use of confined impinging jets. Impinging air jets are a method of increasing convective transfer from a surface and are used in a many applications, they are adopted in drying of textiles, paper, cooling of gas turbine components, freezing of tissue in cryosurgery and manufacturing, electronic cooling. Many existing studies have already indentified the key variables that affect the heat transfer performance of jets impinging on flat plates.

In this paper, impinging jets in porous medium and the lower wall heated at uniform heat flux is studied experimentally and numerically.

In this paper a numerical investigation on impinging jets in metal foam by considering air as fluid is described. A two-dimensional model is developed by means of the FLUENT code. Different Reynolds numbers and Rayleigh numbers were considered. The domain is made of a principal channel and two adiabatic walls, one upstream the principal channel and the other downstream. The target surface is heated by a constant heat flux equal to 500 W/m^2 and 1000 W/m^2. The heated surface is 100 mm long, the distance between two adiabatic walls is 20 and 40 mm. Metal foam of 10 PPI is considered.

The experimental apparatus is made up of a fun systems, a test section, a tube. The tube is long 1000 mm and diameter of 12 mm. The test section has a diameter of 100 mm and thickness equal to numerical model. In the test section the lower plate is in aluminum and is heated by an electrical resistances whereas the upper plate is in plexiglass.

Results in terms of wall temperature profiles, local and average Nusselt numbers are presented for different Reynolds and Richardson number values, pressure drop and friction factor. Besides some preliminary results indicate that the EPR values are promising though comparison to the existing data in literature should be accomplished to validated the present investigation. Some comparison between experimental and numerical results are accomplished.