## Abstract

The [metal foam](https://www.sciencedirect.com/topics/engineering/metal-foam) is a type of [porous media](https://www.sciencedirect.com/topics/engineering/porous-medium) that can be characterized by high porosity, tortuous flow paths, high [strength to weight ratio](https://www.sciencedirect.com/topics/engineering/strength-to-weight-ratio) and [high thermal conductivity](https://www.sciencedirect.com/topics/engineering/high-thermal-conductivity). Due to these features the metal foam is used in many engineering applications such as heat exchanges. Therefore, a new design of a circular pipe partially filled with a grooved [metallic foam](https://www.sciencedirect.com/topics/engineering/metallic-foam) is proposed in order to improve the hydraulic and thermal performance, and consequently reduce the pumping power losses and the metal foam volume.

In the current work, the non-Darcy laminar [forced convection](https://www.sciencedirect.com/topics/chemical-engineering/forced-convection) flow is considered under the [thermal boundary condition](https://www.sciencedirect.com/topics/engineering/thermal-boundary-condition) of constant wall heat flux. The governing equations are solved using the [finite volume method](https://www.sciencedirect.com/topics/engineering/finite-volume-method) (FVM) with temperature-dependent water properties. The variable parameters are; the pitch of the helical grooves, the number of helical grooves and the aspect ratio (Ri: [diameter ratio](https://www.sciencedirect.com/topics/engineering/diameter-ratio) of the metal foam to the pipe). The results show that for Ri = 0.55, four helical grooves having two pitches provides the optimal increase in the Nu number (7%) and the PEC is around 1.21 with a reduction in the pumping power and the amount of the metal foam about 25% and 16.74%, respectively, at Re = 1000.