Effect of transverse magnetic field on the conducting fluid flow through pipe with constriction

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Abstract: The influence of transverse magnetic field on the electrically conducting fluid flow through a channel with a constriction in the middle is studied using OpenFOAM. The effects of the Reynolds number and Hartmann number on the flow parameters are discussed. Numerical simulations are performed using mhdFoam, an OpenFOAM solver for incompressible MHD flow.

Magnetohydrodynamics deals with the behaviour of the flow of electrically conducting fluid in the electromagnetic field. Magnetohydrodynamics has wide application in geophysics, astrophysics, engineering and medical field. The study of MHD flow inside channels and pipe are rudimentary in engineering applications like in metallurgical industries, nuclear fusion reactor and MHD power generators. And, in many such applications, devices like orifices, valves and nozzles are present. These devices are often used to reduce the pressure or to reduce the flow rate or used as a flow measurement devices. Hence, the study of MHD flow through such constricted passage forms a basis for these engineering and scientific application.

Geometric detail: Length of the channel, L = 8 m ; Width of the channel, W = 0.5 m ; Width of the constriction, H = 1 m ; Height of the constriction, d = 0.125 m

The flow is investigated at three different Reynolds number (Re = 50, 100, 150) and four different Hartmann number (Ha = 0, 10, 20, 30) at constant Reynolds number of 150 and constant magnetic Reynolds number of 15.

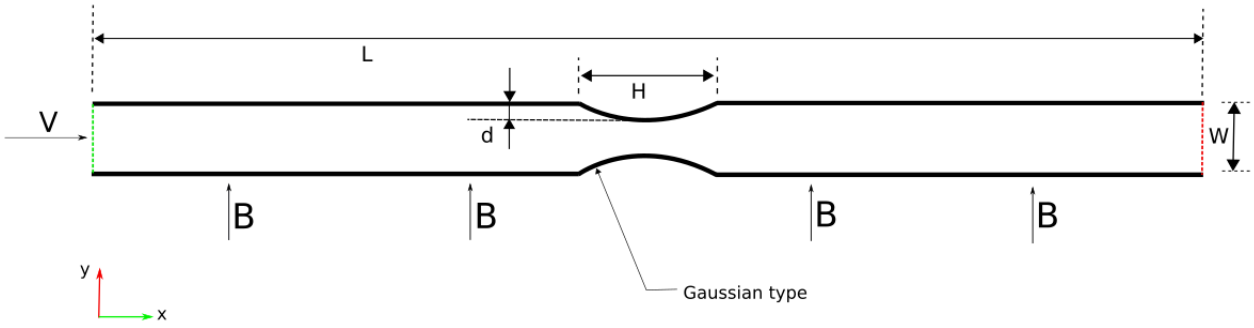

Fig. 1: Case setup