# Convection heat transfer under the effect of uniform and periodic magnetic fields with uniform internal heat generation: a new comprehensive work to develop the ability of the multi relaxation time lattice Boltzmann method

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## Abstract

The purpose of the present work is to investigate the effect of the angle of application of magnetic field in two types of uniform and non-uniform on the nanofluid flow characteristics and natural convection heat transfer in the presence of uniform heat generation. This numerical study was performed using multi relaxation time lattice Boltzmann method (MRT-LBM). The $D_2Q_9$ and $D_2Q_5$ grid arrangements were used to simulate the flow and temperature fields, respectively. The results show that in all cases, increasing the strength of magnetic field (the Hartmann number) reduces the average Nusselt number, which increases with increasing the heat generation coefficient. Applying a magnetic field horizontally results in an average of about 15% lower Nusselt number compared to the vertical. Increasing the strength of magnetic field (the Hartmann number) and the average Nusselt number is achieved by periodically applying a magnetic field instead of applying a uniform one. As the aspect ratio of the cavity increases, the non-uniform effect of applying a magnetic field becomes more apparent.