

## Documents

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**Mixed convection of a nanofluid in a three-dimensional channel: Effect of opposed buoyancy force on hydrodynamic parameters, thermal parameters and entropy generation**

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**Abstract**

Abstract: The paper presents the mixed convection heat transfer and entropy generation of a nanofluid containing carbon nanotubes, flowing in a 3D rectangular channel, subjected to opposed buoyant forces. The governing equations, including the continuity, momentum and energy equations, have been numerically solved using the finite volume technique. The results, including the contours of the axial velocity and temperature, have been presented for different values of the opposed buoyancy parameter ( $-300 < \Omega < -100$ ). The outcomes show that with an increase in the opposed buoyancy parameter, the nanofluid velocity near the channel wall drastically reduces and, therefore, causes a reduction in the Nusselt number. In addition, due to the occurrence of backflow phenomenon, an increment of the opposed buoyancy parameter enhances the total entropy generation along the channel. In brief, the friction-induced entropy generation is negligible compared with the entropy generation due to heat transfer. Finally, by increasing the value of the opposed buoyancy parameter, the ratio of the heat transfer rate to irreversibility decreases within the system. Graphical abstract: [Figure not available: see fulltext.]. © 2018, Akadémiai Kiadó, Budapest, Hungary.

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