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A numerical analysis of laminar forced convection and entropy generation of a diamond-Fe 3 O 4 /water hybrid nanofluid in a rectangular minichannel
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Abstract
The convective heat transfer and entropy generation of diamond-Fe 3 O 4 /water hybrid nanofluid through a rectangular minichannel is numerically investigated under laminar flow conditions. Nanoparticle volume fractions for diamond-Fe 3 O 4 /water hybrid nanofluid are in the range 0.05-0.20% and Reynolds number varies from 100 to 1000. The finite volume method is used in the numerical computation. The results obtained for diamond-Fe 3 O 4 /water hybrid nanofluid are compared with those of diamond/water and Fe 3 O 4 /water conventional nanofluids. It is found that 0.2% diamond-Fe 3 O 4 hybrid nanoparticle addition to pure water provides convective heat transfer coefficient enhancement of 29.96%, at Re=1000. The results show that diamond-Fe 3 O 4 /water hybrid nanofluid has higher convective heat transfer coefficient and Nusselt number when compared with diamond/water and Fe 3 O 4 /water conventional nanofluids. For diamond-Fe 3 O 4 /water hybrid nanofluid, until Re=600, the lowest total entropy generation rate values are obtained for 0.20% nanoparticle volume fraction. However, after Re=800, diamond-Fe 3 O 4 /water hybrid nanofluid with 0.20% nanoparticle volume fraction has the highest total entropy generation rate compared to other nanoparticle volume fractions. A similar pattern emerges from the comparison with diamond/water and Fe 3 O 4 /water conventional nanofluids. For 0.2% nanoparticle volume fraction, diamond-Fe 3 O 4 /water hybrid nanofluid and diamond/water nanofluid have their minimum entropy generation rate at Re=500 and at Re=900, respectively. Moreover, this minimum entropy generation rate point changes with nanoparticle volume fraction values of nanofluids. © 2019 Isfahan University of Technology.

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