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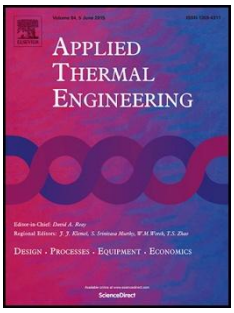

Title: Numerical investigation of nanofluid natural convection coupling with nanoparticles sedimentation

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Numerical investigation of nanofluid natural convection coupling with nanoparticles sedimentation

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Research highlights:

- Nanofluid natural convection and nanoparticles sedimentation were combined in CFD
- Several new OpenFOAM solvers were developed based on different simulation ideas
- Nanoparticles sedimentation has noticeable impacts on nanofluid natural convection
- Nanofluid natural convection also has strong effects on nanoparticles sedimentation
- Temperature-dependent nanofluid property variations are not recommended in CFD

Abstract:

This paper aims to investigate the relationships between nanofluid natural convection and nanoparticles sedimentation through open source computational fluid dynamics (CFD) simulations. Three new OpenFOAM solvers are developed based on different approaches in both single- and multi-phase ways. Considering 0.64% Al_2O_3/water nanofluid in a two-dimensional square cavity, nanoparticles sedimentation is believed to have considerable impact on nanofluid natural convection when Rayleigh number is in the range of $Ra = 10^6 \sim 10^7$. With a sedimentation layer of nanoparticles at cavity bottom, average Nusselt number along heating wall is found to be lower than that in the corresponding case simulated via single-phase approach. Furthermore, the impact of nanofluid natural convection on nanoparticles sedimentation is found to be increasingly remarkable when Rayleigh number is increased. In present work, pure water is found to have slightly greater average Nusselt number than 0.64% Al_2O_3/water nanofluid. It is also recommended that

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