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Editorial

Recent Trends in Nanofluids

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1. Introduction

In various industrial technologies, ultrahigh-performance cooling is an essential requirement. However, genetically lower thermal conductivity is a significant issue in producing more energy-efficient heat transfer fluids that are necessary for ultrahigh-performance cooling. In the recent development of nanotechnology, metallic and non-metallic nanoparticles can be made in smaller sizes. They have unique, magnetic, mechanical, thermal, electrical, and optical features. Nanofluids can be obtained by suspending small particles smaller than 100 nm in the working fluid, i.e., water, oil, and ethylene glycol. When the nanoparticles are uniformly dispersed and added to the base fluids, the suspension of nanoparticles shows a dramatic enhancement in the thermal features of the base fluids. Choi introduced nanofluids in 1995 to explain the new branch of nanotechnology-based heat transfer fluids that reveal thermal features that are higher than those of their base fluids or the conventional particle-fluid suspensions. The primary purpose of the nanofluid is to obtain the highest possible thermal features at the smallest possible concentration (i.e., less than 1% by volume) by stable suspension and uniform dispersion of nanoparticles (preferably less than 10 nm) in the base fluids. Therefore, to obtain this target, it is essential to estimate how these nanoparticles can improve energy propagation in fluids.

Considering the importance of nanofluids in various areas of science, the Special Issue on "Recent trends in nanofluids" and "Recent trends in nanofluids-II" was introduced. In total, 17 papers were submitted to this Special Issue, and out of them, 11 were selected for publication.

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Citation: Bhatti, M.M. Recent Trends in Nanofluids. *Inventions* **2021**, *6*, 39. https://doi.org/10.3390/inventions6020039

Received: 15 May 2021
Accepted: 28 May 2021
Published: 1 June 2021

2. Recent Trends in Nanofluids

The authors in [1] investigated the magnetized entropy generation with the peristaltic phenomena of nanofluid. The formulated equations, i.e., momentum, energy, and concentration equations, have been formulated by contemplating a low Reynolds number and long wavelength approximations. The perturbation technique has been used to obtain the solutions of the nonlinear differential equation. It is noted that entropy generation is 81% variability against the Hartman number, 99% against the Brownian motion parameter, 40% against the thermophoresis parameter, and 100% against the Brinkmann number. Furthermore, the temperature profile shows a rise due to an increment in thermophoresis and Brownian motion parameters.

In [2], the authors discussed the unsteady, incompressible Bingham fluid transporting through a pair of parallel plates. The lower plate is stationary while the upper plate is moving. The mathematical formulation is performed with transformation and examined numerically by employing the explicit finite difference scheme.

In [3], they discussed the power-law nanofluid model moving through three configurations, i.e., plate, wedge, and cone. They contemplated variable temperature at the wall and used the Buongiorno model. The homotopy analysis method was proposed to solve the mathematical formulation. According to their outcomes, they found that solutal and thermal Grashof numbers remarkably enhance the velocity, while they oppose the temperature and the nanoparticle concentration. Moreover, the concentration and thermal boundary layers over the wedge are modified dramatically, compared with cone and plate configurations.

In [4], the authors presented numerical research on the impact of nanomaterials on a lid-driven cylindrical cavity. A finite element scheme was used to determine the solutions against the possible parameters. They found that the Reynolds number substantially changes the impact of nanoparticles on the rate of heat transfer. Further, they noticed that the Nusselt number could be enhanced by changing the height ratio, while the size and the number of vortices change inside the cavity.

Abbas et al. [5] contemplated blood flow under the impact of thermal radiation, magnetic field, and chemical reaction. They used the lubrication approach to formulate mathematical modeling. They used the perturbation approach to solve the nonlinear differential equations. The behavior of the chemical reaction is converse closers to the walls, whereas the thermal radiation resists the temperature profile. Peristaltic pumping rate increases due to the strong impact of the magnetic field and the thermal Grashof number.

Ellahi et al. [6] contemplated the role of slip conditions with the two-phase non-Newtonian fluid model. Further, they considered Hafnium nanoparticles. They considered particle and fluid phases. The proposed cases are determined for three kinds of geometries. Analytical solutions are presented against particle and fluid phases.

3. Recent Trends in Nanofluids-II

Al-Khaled and Khan [7] discussed the applications of nanoparticles that are beneficial in engineering. They explored the thermal features of the Casson nanofluid model, which contains gyrotactic microorganisms propagating through a moving surface. The foundational properties of mass and heat transfer mechanisms are discussed by examining the temperature-dependent viscosity. Further, they reported the effects of thermophoretic and Brownian motion by employing Buongiorno's mathematical model.

Pattnaik et al. [8] investigated the mechanism of Al_2O_3 nanoparticles suspended in ethylene glycol fluid. They employed Koo–Kleinstreuer–Li (KKL) model to examine the flow characteristics. They used the Adomian Decomposition approach with a combination of shooting schemes. They analyzed that extraction in width tends to the fluid to propagate away from the lower plate. At the same time, it moves closer to the upper plate, and sudden decrement is found in the temperature profile when alumina–EG nanofluids are contemplated.

Shahid [9] determined the impact of magnetized, upper-convected Maxwell fluid with mass transfer propagating through a porous elastic surface. Further, they employed the successive linearization method using MATLAB software to examine the physical impact of various parameters. They also presented a comparison with similar methods to show the accuracy and the validity of the proposed methodology.

Khan and Yang [10] presented a magnetized thermomechanical coupling mechanism of nanofluid over a stretched surface under the impact of a magnetic dipole. Further, they used chromium-nickel-cobalt-tungsten alloy and magnetite ferrite nanoparticles suspended in ethylene glycol. Fourier's law of heat conduction was used to determine the heat transmission rate.

Lastly, Bhatti [11] studied gold nanoparticles suspended in electrically conducting Jeffrey fluid propagating through a finite wavy asymmetric channel. The lubrication approach was used to formulate the mathematical modeling. Further, they also examine the effects of thermal radiation, magnetic field, and viscous dissipation. The perturbation approach was used to determine the solutions for the nonlinear differential equations.

Funding: This research received no external funding.

Conflicts of Interest: The authors declare no conflict of interest.

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