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Numerical Analysis of Heat Transfer and Nanofluid Flow in a Triangular Duct with Vortex Generator: Two-Phase Model (Article)

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Abstract

Laminar forced convection **heat transfer** and nanofluids **flow in** an equilateral **triangular** channel using **a** delta-winglet pair of **vortex** generators is numerically studied. Three nanofluids, namely; Al_2O_3, CuO, and SiO_2 nanoparticles suspended **in** an ethylene glycol base fluid are examined. **A two-phase** mixture **model** is considered to simulate the governing equations of mass, momentum and energy for both phases and solved using the finite volume method (FVM). Constant and temperature dependent properties methods are assumed. The single-**phase model** is considered here for comparison. The nanoparticle concentration is assumed to be 1% and 4% and Reynolds number is ranged from 100 to 800. The results show that the **heat transfer** enhancement by **a** using **vortex generator** and nanofluids is greater than the case of **vortex generator** and base fluid only, and the latest case provided higher enhancement of **heat transfer** compared to the case of **a** base fluid flowing **in a** plain **duct**. Considering the **nanofluid** as **two** separated phases is more reasonable than assuming the **nanofluid** as **a** homogeneous single **phase**. Temperature dependent properties **model** provided higher **heat transfer** and lower shear stress than the constant properties **model**. © 2014 Wiley Periodicals, Inc.

Author keywords

Heat transfer; **Nanofluid**; **Triangular duct**; **Two-phase**; **Vortex generator**

Indexed keywords

Engineering controlled terms: Delta wing aircraft; Ducts; Ethylene; Ethylene glycol; Finite volume method; **Heat** convection; **Heat transfer**; Nanoparticles; Reynolds number; Shear stress; **Vortex flow**; Vorticity

Enhancement of **heat transfer**; **Heat Transfer** enhancement; Laminar forced convections; Nanofluids; Nanoparticle concentrations; Temperature-dependent properties; **Two phase**; **Vortex** generators

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Keywords

Author Keywords: heat transfer; nanofluid; triangular duct; vortex generator; two-phase
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