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Numerical Investigation of Flow and Heat Transfer Characteristics of a Natural Refrigerant within a Vortex Tube

Authors : Mirza Popovac

Abstract : This paper investigates the application of the vortex tubes towards increasing the efficiency of high temperature heat pumps based on natural refrigerants, by recovering a part of the expansion work within the refrigerant cycle. To this purpose the 3D Navier-Stokes solver is used to perform a set of numerical simulations, investigating the vortex tube performance. Firstly, the fluid flow and heat transfer characteristics are analyzed for standard configurations of vortex tubes, and the obtained results are validated against the experimental and numerical data available in literature. Subsequently, different geometry specifications are analyzed, as well as the interplay between relevant heat pump operating conditions and the properties of natural refrigerants. Finally, the characteristic curve of performance will be derived for investigated vortex tubes specifications when used within high temperature heat pumps.

Keywords : heat pump, vortex tube, CFD, natural refrigerant
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