

CFD Simulation of the Inlet Pressure Effects on the Cooling Capacity Enhancement for Vortex Tube with Couple Vortex Chambers

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Abstract : This article investigates the effects of inlet pressure in a newly introduced vortex tube which has been equipped with an additional vortex chamber. A 3-D compressible turbulent flow computation has been carried out toward analysis of complex flow field in this apparatus. Numerical results of flows are derived by utilizing the standard k- ϵ turbulence model for analyzing high rotating complex flow field. The present research has focused on cooling effect and given a characteristics curve for minimum cool temperature. In addition, the effect of inlet pressure for both chambers has been studied in details. To be presented numerical results show that the effect of inlet pressure in second chamber has more important role in improving the performance of the vortex tube than first one. By increasing the pressure in the second chamber, cold outlet temperature reaches a higher decrease. When both chambers are fed with high pressure fluid, best operation condition of vortex tube occurs. However, it is not possible to feed both chambers with high pressure due to the conditions of working environment.

Keywords : energy separation, inlet pressure, numerical simulation, vortex chamber, vortex tube

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