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CFD tool for analysis and design of ranque–Hilsch vortex tube

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Abstract

Typical Ranque-Hilsch Vortex tubes(RHVT) are operated by adjusting the hot outlet exit area to obtain the desired cold exit mass fraction and temperature. There is an unknown relationship between the hot outlet exit area and pressure that limited computational fluid dynamics(CFD) solutions to cases where experimental measurements of pressure are available. A new CFD tool is developed to generalize the analysis, design and optimization of the RHVT without depending on experimental measurements. This is achieved by adding the computational domain far downstream at both outlets where the atmospheric pressure is enforced as a boundary condition. Thus, converged numerical solutions are obtained and the pressure at both hot and cold outlets are computed. Numerical results are obtained and compared with the experimental data and other numerical result. The computed results at both outlets compare very well with available experimental data and the computed internal flow parameters compare well with the previous numerical as well.

Biography

Shaaban Abdallah, a professor of Aerospace Engineering, has been at the university of Cincinnati since 1989. He obtained his PhD in Aerospace Engineering at the university of Cincinnati in 1980. Dr. Abdallah joined Penn State University from 1981 to 1988. His research interests include Computational Fluid Dynamics, nanofluids, Turbo-machines, Unmanned Aerial Vehicles and Medical devices. Dr. Abdallah has two US patents on centrifugal compressors and three disclosures with university of Cincinnati on medical devices.