

## A Counter-flow Vortex Tube With Energy Separation: An Experimental Study and CFD Analysis

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**Abstract :** Experimental and numerical investigations have been carried out to study the mechanism of separation energy and flow phenomena in the counter-flow vortex tube. This manuscript presents a complete comparison between the experimental investigation and CFD analysis. The experimental model tested under different inlet pressures. Three-dimensional numerical modelling using the k- $\epsilon$  model. The results show any increase in both cold mass fraction and inlet pressure caused to increase  $\Delta T_c$ , and the maximum  $\Delta T_c$  value occurs at  $P = 6$  bar. The coefficient of performance (COP) of two important factors in the vortex tube have been evaluated, which ranged from 0.25 to 0.74. The maximum axial velocity is 93, where it occurs at the tube axis close the inlet exit ( $Z/L=0.2$ ). The results showed a good agreement for experimental and numerical analysis.

**Keywords :** counter flow, vortex tube, computational fluid dynamics analysis, energy separation, experimental study

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