World Academy of Science, Engineering and Technology
International Journal of Mechanical and Industrial Engineering
Vol:13, No:12, 2019

Numerical Analysis of Flow in the Gap between a Simplified Tractor-Trailer Model and Cross Vortex Trap Device

Authors : Terrance Charles, Zhiyin Yang, Yiling Lu

Abstract : Heavy trucks are aerodynamically inefficient due to their un-streamlined body shapes, leading to more than of 60% engine power being required to overcome the aerodynamics drag at 60 m/hr. There are many aerodynamics drag reduction devices developed and this paper presents a study on a drag reduction device called Cross Vortex Trap Device (CVTD) deployed in the gap between the tractor and the trailer of a simplified tractor-trailer model. Numerical simulations have been carried out at Reynolds number 0.51×10⁶ based on inlet flow velocity and height of the trailer using the Reynolds-Averaged Navier-Stokes (RANS) approach. Three different configurations of CVTD have been studied, ranging from single to three slabs, equally spaced on the front face of the trailer. Flow field around three different configurations of trap device have been analysed and presented. The results show that a maximum of 12.25% drag reduction can be achieved when a triple vortex trap device is used. Detailed flow field analysis along with pressure contours are presented to elucidate the drag reduction mechanisms of CVTD and why the triple vortex trap configuration produces the maximum drag reduction among the three configurations tested.

Keywords : aerodynamic drag, cross vortex trap device, truck, Reynolds-Averaged Navier-Stokes, RANS
Conference Title : ICFM 2019 : International Conference on Fluid Mechanics
Conference Location : London, United Kingdom
Conference Dates : December 09-10, 2019