World Academy of Science, Engineering and Technology
International Journal of Aerospace and Mechanical Engineering
Vol:15, No:07, 2021

Effect of Needle Height on Discharge Coefficient and Cavitation Number

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Abstract : Cavitation inside diesel injector nozzle is investigated using Reynolds-Stress-Navier Stokes equations. Schnerr-Sauer cavitation model is used for modeling cavitation inside diesel injector nozzle. The carrying fluid utilized in the current study is diesel fuel. The flow is verified at the beginning by comparing with the previous experimental data, and it was found that K-Epsilon turbulent model could lead to a better accuracy comparing to K-Omega turbulent model. Moreover, the mass flow rate obtained numerically is compared with the experimental value, and the discrepancy was found to be less than 5 percent which shows the accuracy of the current results. Finally, a real-size four-hole nozzle is investigated, and the flow inside it is visualized based on velocity profile, discharge coefficient, and cavitation number. It was found that the mesh density could be reduced significantly by utilizing periodic boundary conditions. Velocity contour at the mid nozzle showed that the maximum value of velocity occurs at the end of the needle before entering the orifice area. Last but not least, at the same boundary conditions, when different needle heights were utilized, it was found that as needle height increases with an increase in cavitation number, discharge coefficient increases, while the mentioned increases are more tangible at smaller values of needle heights.

Keywords : cavitation, diesel fuel, CFD, real size nozzle, mass flow rate
Conference Title : ICAFM 2021 : International Conference on Advances in Fluid Mechanics
Conference Location : Ottawa, Canada
Conference Dates : July 12-13, 2021