Simulation of 3-D disinfectant spray to study optimal spray cone angle and discharge rate

Monalisha

Department of Civil and Environment Engineering

Birla Institute of Technology, Mesra, Ranchi

22/06/2020

ABSTRACT

Despite the controversies surrounding the use of disinfectant tunnel, they are still used in many partsof the world as an augment to the fight against SARS-CoV-2. Since 99 percent [10] of such disinfectant spray is water, it is necessary to use it efficiently to conserve water. So,one of the ways to conserve the water is to increase the coverage area of the spray for the given disinfectant fluid. This project aims to present 3-dimensional simulation of spray and to obtain the optimum discharge and spray cone angle to have the maximum coverage area using OpenFOAM -v7. In this project, I have used sprayFoam solver; RAS (k-epsilon) turbulence model; the discrete medium is water. The discrete medium is treated as water because 99% of disinfectant is water

PPROBLEM STATEMENT

I have simulated 2 case setups. Case 01 is the validation case setup and Case 02 is the Optimization case. The computational domain used for the setup is 20cm *30cm*20cm (figure 01). 2mm is the cell size in all the directions. Meshing is done using blockMesh (OpenFOAM -V6). The diameter of the nozzle is 1.54mm. The pressure injection is 5 atm. The sprayed liquid is water and it is sprayed in air. The initial pressure and temperature in the computational domain is 1 atm and 298.15 K. I have used sprayFOAM solver and RAS (k-Epsilon) turbulence model for this project. Case 01 and Case 02 have same setup except the two parameters. They are: -

For Case 01: - Cone Angle is 56^0 and Flow rate 0.05 Kg /s.

For Case 02: - Cone Angle is 45^0 and Flow rate is 9.2 Kg/s.

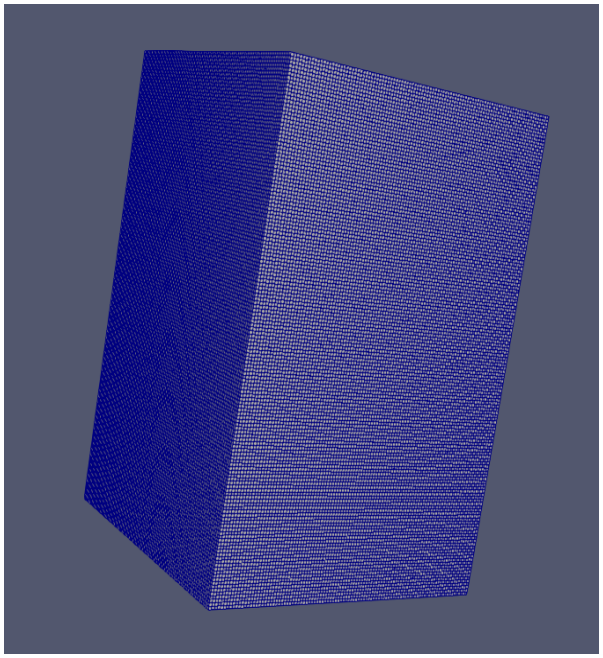

figure 01: - Meshed Geometry