CFD Simulation of Thermal Management System (Immersion Cooling) of Lithium Ion Batteries in EVs

Manthan Dhisale
Department of Mechanical Engineering, Indian Institute of Technology, Bombay
Date: 16/04/2021

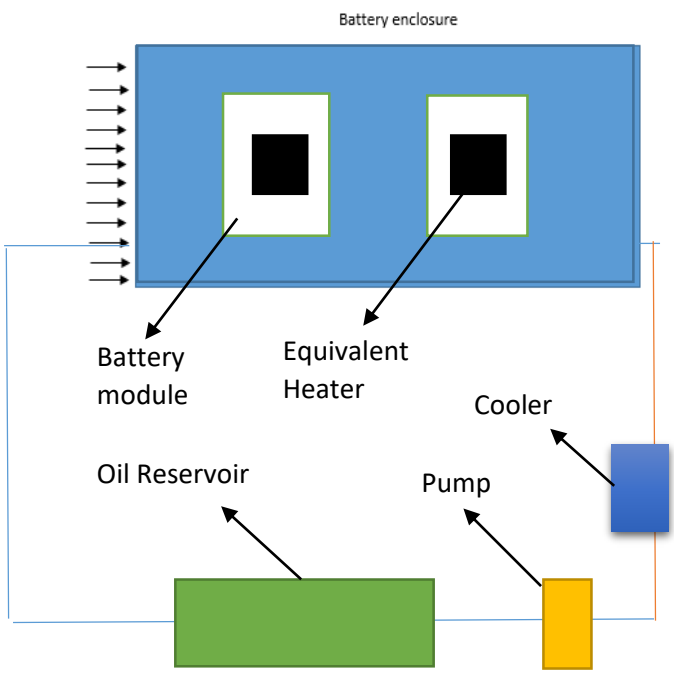
ABSTRACT

The future of mobility belongs to electric vehicles, as various governments worldwide are aggressively supporting its adoption. The market for electric cars is showing rapid growth for the last few years, and as the adoption of these vehicles increases, so the demand for high range, fast charging, and safety. To meet these demands, manufacturers need to increase the battery density to increase the rage; simultaneously, these high-powered batteries need quick chargers and a better cooling system to improve safety. With faster charging-discharging cycles, there comes a challenge to maintain the efficiency of lithium ion batteries for faster heat dissipation. One such way is immersion cooling, which has recently started to be practiced in EVs.

PROBLEM STATEMENT:

The flow for final simulation is assumed to be incompressible, laminar and unsteady. Initially a worse case check was done for turbulent model using PisoFoam for vertical configuration and was found that, there isn't a significant effect of vortex formation over the batteries. So the final simulation will be as defined for a fluid and heat transfer study using chtMultiregion Foam on the horizontal configuration of batteries. The geometry required for the simulation will be coded in the blockMeshDict file without importing. Various Liquid coolants: Oils and fluorocarbons will be checked for the efficient temperature drop for the batteries. The number of batteries will be kept variable based on the time taken for simulation. Output from the simulation study will be the Velocity, Pressure and Temperature contours along with 2D plots of temperature variation (average, volumetric) w.r.t time. (Enclosure: Simulation area)

Vertical Config.



Horizontal Config.