Abstract

Human needs of vehicle especially in Indonesia increase from time to time. Hence, it need to be designed a domestic made vehicle that able to satisfy Indonesia’s people needs. One of steps in development of national vehicle production is piston modification. Piston is one of the most importance parts in a vehicle engine. Geometry and dimension changing of piston will certainly change piston ability to accept its load. The piston load is from the stress of pressure and thermal that resulted by combustion. Further, the loads generate deformation. The deformation need to observed because it can disturb combustion process if the deformation value is not in its tolerance.

This research is conducted by collecting piston data that include dimension, geometry, material, pressure, and temperature. Piston is modeled in 3D form that based on collected data of piston geometry and dimension. The simulation choose thermal-stress analysis that combined from static structural analysis and steady-state thermal analysis. 3D model is imported to numerical simulation software. Before it, in engineering data of simulation software was filled with used material properties. 3D model is meshed to break into small elements. The determined boundary condition is pressure, support, acceleration, and gravitation in static structural analysis and temperature and convection coefficient in steady-state thermal analysis. The solution of numerical simulation is chosen
to temperature, stress, displacement, safety factor, and life cycle. Then the results from simulation is analyzed.

Maximum stress in existing piston is 201 MPa and modification piston is 264 MPa. Maximum deformation in piston existing is 0.126 mm and modification piston is 0.298 mm. Safety factor that based on Maximum Shear Stress Theory on existing piston is 1.34 and modification piston is 1.03. Safety factor that based on Maximum Distortion Energy Theory on existing piston is 1.39 and modification piston is 1.05. Life cycle of existing piston is $4.92 \times 10^5$ and modification piston is $0.096 \times 10^5$. From the results, modification piston need to redesign so it is strong enough to accept its load.

Keywords: Piston, Numerical Simulation, Strength of Material, Deformation