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Design and Analysis of An Automotive Single Plate Friction Clutch Using Different Materials

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ABSTRACT

An automotive clutch is a mechanical device used in a vehicle to transmit motion from a driving shaft to a driven shaft at the will of an operator. At present, there are various types of automotive clutch with diverse specifications used in different vehicles. These clutches differ mainly in geometry, material and operating mechanism. A single plate friction clutch mainly consists of a clutch disc with two friction linings on both sides of it. The performance of a friction clutch is evaluated on the basis of various properties like structural properties, torque carrying capacity, and thermal properties. These properties vary considerably by using different friction materials in a clutch plate. Thus, for the optimal design of a clutch plate material selection plays a vital role. This paper presents the design and analysis of a single plate friction clutch using different friction lining materials (organic resin, ceramic, and cermet). In this work, first we selected the clutch plate of the Tata Super Ace vehicle as a basis for the analysis and noted the specifications of this vehicle like maximum power and maximum torque. Then we calculated all the numerical data for input by analytical methods using different materials. Using this numerical data, we designed the clutch plate model in Solid works software, then carried out the structural and thermal analysis in Ansys software. During analysis, we obtained total deformation, equivalent Von-Mises stress, factor of safety, and temperature values of the automotive clutch plate for different friction materials. After analysis, we compared the output results and selected the comparatively best material among organic resin, ceramic, and cermet for the optimal design of the clutch plate.

Keywords: - Friction clutch, optimal design, Material selection, structural analysis, thermal analysis, Ansys.