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Systems Approach on Thermal Analysis of an Automatic Transmission

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Abstract : In order to increase the performance of an automatic transmission, the automatic transmission fluid is required to be warm up to an optimal operating temperature. In a conventional vehicle, cold starts result in friction loss occurring in the gear box and engine. The stop and go nature of city driving dramatically affect the warm-up of engine oil and automatic transmission fluid and delay the time frame needed to reach an optimal operating temperature. This temperature phenomenon impacts both engine and transmission performance but also increases fuel consumption and CO2 emission. The aim of this study is to develop know-how of the thermal behavior in order to identify thermal impacts and functional principles in automatic transmissions. Thermal behavior was studied using models and simulations, developed using GT-Suit, on a one-dimensional thermal and flow transport. A power train of a conventional vehicle was modeled in order to emphasis the thermal phenomena occurring in the various components and how they impact the automatic transmission performance. The simulation demonstrates the thermal model of a transmission fluid cooling system and its component parts in warm-up after a cold start. The result of these analyses will support the future designs of transmission systems and components in an attempt to obtain better fuel efficiency and transmission performance. Therefore, these thermal analyses could possibly identify ways that improve existing thermal management techniques with prioritization on fuel efficiency.

Keywords : thermal management, automatic transmission, hybrid, and systematic approach
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