

Optimization-Based Design Improvement of Synchronizer in Transmission System for Efficient Vehicle Performance

Authors : Sanyka Banerjee, Saikat Nandi, P. K. Dan

Abstract : Synchronizers as an integral part of gearbox is a key element in the transmission system in automotive. The performance of synchronizer affects transmission efficiency and driving comfort. Synchronizing mechanism as a major component of transmission system must be capable of preventing vibration and noise in the gears. Gear shifting efficiency improvement with an aim to achieve smooth, quick and energy efficient power transmission remains a challenge for the automotive industry. Performance of the synchronizer is dependent on the features and characteristics of its sub-components and therefore analysis of the contribution of such characteristics is necessary. An important exercise involved is to identify all such characteristics or factors which are associated with the modeling and analysis and for this purpose the literature was reviewed, rather extensively, to study the mathematical models, formulated considering such. It has been observed that certain factors are rather common across models; however, there are few factors which have specifically been selected for individual models, as reported. In order to obtain a more realistic model, an attempt here has been made to identify and assimilate practically all possible factors which may be considered in formulating the model more comprehensively. A simulation study, formulated as a block model, for such analysis has been carried out in a reliable environment like MATLAB. Lower synchronization time is desirable and hence, it has been considered here as the output factors in the simulation modeling for evaluating transmission efficiency. An improved synchronizer model requires optimized values of sub-component design parameters. A parametric optimization utilizing Taguchi's design of experiment based response data and their analysis has been carried out for this purpose. The effectiveness of the optimized parameters for the improved synchronizer performance has been validated by the simulation study of the synchronizer block model with improved parameter values as input parameters for better transmission efficiency and driver comfort.

Keywords : design of experiments, modeling, parametric optimization, simulation, synchronizer

Conference Title : ICAAE 2018 : International Conference on Applications of Automobile Engineering

Conference Location : Venice, Italy

Conference Dates : April 12-13, 2018