



**Iran University of Science and Technology  
Faculty of Mechanical Engineering**

# **Optimisation of the Gearshift Strategy for a Hybrid Electric Vehicle Equipped with AMT**

**Thesis for the  
Degree of Master of Science in Mechanical Engineering**

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## Abstract

In recent years, hybrid electric vehicles have been introduced as a feasible key technology for resolving the problems of conventional vehicles. The power transmission unit plays an important role in hybrid power train. The application of a smart power transmission helps achieve better compatibility between components in a hybrid electric vehicle. Nowadays, automated manual transmission (AMT) has drawn car manufacturers' attentions to itself, since it provides the benefits of both automatic and manual transmissions. High efficiency, low cost and low weight of a manual transmission and the smooth gearshift and convenient driving of an automatic transmission can be integrated in an automated manual transmission. Furthermore AMT's controllability turns it into a decent candidate for hybrid electric vehicle's power transmission.

In this thesis, an AMT model is provided and added to a pre-transmission parallel hybrid vehicle model. The gearshift algorithm is based on the optimal region of the engine and the control strategy is a fuzzy controller.

Since the design of the gear shift strategy, control strategy and gear ratio has a dramatic influence on vehicle fuel consumption and performance, the genetic algorithm optimization is used to find the optimum solution. The fitness function is a summation of the normalized fuel consumption and emissions. The vehicle performance is regarded as the penalty constrain. The optimization process has been done according to the different driving conditions of TEH-CAR driving cycle. TEH-CAR is a driving cycle developed for Tehran based on the experimental data collected from the real traffic. For this purpose four different traffic conditions have been categorized. The results illustrated that by considering the counteraction of gear ratio selection and gear shift strategy, the fuel economy has been noticeably improved, especially during the congested driving condition, due to its sensitivity to the stop-start operation of the vehicle.