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

**Simulation of
Energy Regeneration of Active Suspension System
in Hybrid Electric Vehicles**

**A Thesis Submitted in Partial Fulfillment of the Requirement for the
Degree of Master of Science in Mechanical Engineering**

By:

Sahar Hashemi Zonouzi

Supervisor:

Dr. Morteza Montazeri

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Abstract

Active suspension (AS) systems improve ride comfort and stability of vehicles by control of vehicle body vibration. Actuators of active suspension system either insert energy to the system or extract the energy of vibrations from the system, when required. Using an energy regeneration system, the extracted energy can be converted to electric energy and stored in an energy storage system.

In this thesis, energy regeneration of active suspension system in hybrid electric vehicle (HEV) is studied. For this purpose, at first the vehicle suspension system is simulated using a 7DOF model and the amount of energy at any moment is calculated. In addition, the HEV powertrain is simulated using ADVISOR software. Then, for investigation of the effect of the energy regeneration on vehicle's fuel consumption and exhaust emissions, a new method for simultaneous simulation of both powertrain system and AS system is proposed. Moreover, a hybrid battery/ultracapacitor energy storage system is employed for AS power supply in this work. The influence of road disturbance, driving condition and AS control strategy on the AS energy consumption and regeneration and HEV fuel consumption and emissions is also investigated using the proposed approach.

The simulation results demonstrate that in fluent traffic conditions like highway condition, the amount of the regenerated energy is considerable (up to 65% of the consumed energy). Moreover, the energy regeneration of AS compensates for a part of the fuel consumption arisen from application of AS.

Keywords: active suspension, energy regeneration, hybrid electric vehicle