Fuzzy Sliding Mode Control for applying to active vehicle suspentions

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Abstract:- Suspension system is an important part of the car design, because it influences both the comfort and safety of the passengers. Controlling of Suspension system has special difficulties since this system is highly nonlinear, essentially unstable systems and energy demands of the system. In particular, this article is focused on experiments with the physical model of semi-active quarter-car suspension that using the method of fuzzy sliding mode which uses the fuzzy logic techniques to adjust the control gains that occur under the sliding mode.
Functionality of the modification was verified taking various experiments and the results show that the proposed fuzzy controller robustly is efficiency. The computation of the command force to apply to the system in order to control the suspension was based on the fuzzy logic theory for which three essential steps were developed: fuzzification, inferences, and defuzzification. To put into evidence the efficiency and the performances of such a control system, we have compared the results obtained through the sliding mode technique solely, then through the combination of the fuzzy logic theory and the set up by the sliding mode, and the fuzzy sliding mode.

Key-Words: Fuzzy Logic, Active Control, Vehicle Suspension, Sliding Mode.

1. INTRODUCTION

There are three type of vehicle suspension: passive, semiactive and active. Differences depend on the operation mode to improve vehicle ride comfort, vehicle safety, road damage minimization and the overall vehicle performance. Normally, conventional passive suspensions are effective only in a certain frequency range and no on-line feedback action is used. Thus, optimal design performance cannot be achieved when the system and its operating conditions are changed. On the contrary, active suspensions can improve the performance of the suspension systems over a wide range of frequency and can adapt to the system variations based on on-line changes of the actuating force. Nowadays, increased competition on the automotive market has forced companies to research alternative strategies to classical suspension systems. The basic function of the vehicle suspension is to support the weight of the car, maximize the friction between the tires and the road surface, provide steering stability with good handling and ensure sufficient comfort of the passengers. In order to improve handling and comfort performance instead of a conventional static spring and damper system, semi-active and active systems are being developed and also it is essential to conceive optimized suspension systems [1], [2]. As passive suspensions are not always able to meet such requirements, researchers were rather interested rather interested in the conception of semi-active or active suspensions which could change their control parameters in function of the