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AUTOMATIC TYRE PRESSURE REGULATION SYSTEM FOR THE OPTIMIZATION OF RIDE COMFORT

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Comfort is a major concern for a person when selecting a vehicle for his/her personal use. Even though designs that offer a superb ride quality are in the market today, passenger comfort inevitably differs with the terrain and the road profile that the vehicle travels on. More specifically, it is the vibrations transmitted from the road to the vehicle which cause the familiar feeling of tiredness among the passengers. Attempts to dampen these vibrations have resulted in changes of the seat design and modifications to the vehicle suspension. However, the parameter of the vehicle selected for scrutiny in this research is the tyre pressure, as the tyre is the component of the vehicle that is the closest to the source of vibration i.e. the road. A Fuzzy-based algorithm is presented to optimize ride comfort by means of fluctuating vehicle tyre pressure. The defining parameter used in estimating vibrations is the frequency weighted root-mean-squared acceleration with reference to the ISO 2631-1. The aforementioned parameter and the current tyre pressure are passed through the algorithm. The resulting output is an increment or decrement in tyre pressure accomplished by the actuation of pneumatic valves. Decision-making is accomplished by a Mamdani Fuzzy inference system comprising 12 rules formulated by analyzing experimental data collected with the passenger vehicle driven in real-world conditions. The control algorithm is validated by implementing it on an experimental quarter-car model. It is also shown that an optimal tyre pressure exists for each type of terrain when the terrain is categorized according to the frequency weighted root-mean-square acceleration.

Keywords: *acceleration, comfort, Fuzzy, terrain, tyre pressure*