Minimizing Normal Vehicle Forces Effect During Cornering of a Two In-Wheel Vehicle Through the Identification of Optimum Speed via Particle Swarm Optimization (PSO)

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Abstract. Driving comfort is a non-trivial issue as it could pose adverse health issues particularly to those who travel-long distances. In the present study, we identify the optimum speed during cornering in order to reduce the effect of normal vertical forces towards driving experience of a two-in wheel vehicle. A bio-inspired metaheuristic method, namely Particle Swarm Optimization (PSO) was employed to address the objective of the present investigation on a twelve degrees of freedom human biodynamic model that is fused to a two-in-wheel car model. It was established through the PSO algorithm, that the optimal speed during cornering for the given car configuration is approximately 19 km/h. The findings of the present study are essential in ensuring human comfort is not compromised that in turn minimizes possible untoward risk to the driver.

Keywords: PSO · Human comfort · Two-in-wheel vehicle · Optimization

1 Introduction

Ride comfort is a non-trivial issue towards evaluating a vehicle's performance. This topic has received due attention over the years primarily in facilitating the mitigation of adverse health effects that is associated with long-distance travelling and prolonged exposure to vibration. A handful of studies have reported that pointed out the aforesaid issue [1–3]. Nevertheless, the determination of ride comfort that is associated with vibration has been quite a contention between vehicle designers and no common or gold standard has been established thus far [4].

Hitherto, there are a number of studies that have been reported on the employment of optimization techniques to quantify human comfort based on the driving speed [5–8]. For

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