Abstract

This investigation considers the influence of a three spring and damper suspension system (SDS) on overall vehicle performance. Three SDS systems are used in high performance winged racing cars to manage the effects of the aerodynamic forces. The aim of the investigation was to quantify and compare the performance of a three SDS system to that of a conventional two SDS system. The investigation was carried out on the Bailey Cars LMP2 race car. Physical track testing was conducted on Zwartkops Raceway to measure the vehicle's performance, with further testing conducted on the vehicle's tyres. A software model of the vehicle and tyres was then created in ADAMS/Car, with models for the conventional two SDS system, as well as the three SDS system. The ADAMS/Car model was then validated against the test data. A Design of Experiments approach was used to investigate the influence of the parameters in both the suspension models. The optimal set of suspension parameters, that maximised vehicle performance on Zwartkops Raceway, was then identified. The performance of the optimal suspension systems was then compared to quantify the effect of the three SDS system. It was found that the optimised three SDS system travelled 4.38 m less than the optimal two SDS in a 60 second simulation on Zwartkops Raceway. However, the three SDS was effectively able to isolate the pitch and roll stiffness of the vehicle. The optimal three SDS had a greater pitch stiffness and less roll stiffness than the two SDS. This is significant for winged vehicles where aerodynamic forces are highly sensitive to vehicle pitch, such as the Bailey Cars LMP2 race car, allowing for a soft wheel rate without sacrificing the pitch stiffness of the vehicle.