

Impedance control on rack steering vehicle for inertia shaping on cornering track

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Abstract

Overdriven factor in a vehicle motion is one of the issues that need to be tackled for safety and energy efficiencies, especially in the cornering track. This issue is crucial especially for rack steering vehicle with non-holonomic configuration, whereby inertia will contribute to high collisions to the peer walls or offroad incidents. Therefore this study has taken the initiative to propose a dynamic control technique that considers the interaction between the vehicle and the terrain using impedance control. This control technique allows coping with the issue by indirectly shaping inertia forces. The proposed impedance control is derived by handling the vehicle dynamic developed and shaping the vehicle steering angle. For the study purposes, a rack steering four wheels vehicle (RT4WV) is used as a platform, and its dynamic model was derived for analysis. The implementation of torque feedback based impedance control for inertia shaping is emphasized on both vertical (x axis) and horizontal (y axis) of the vehicle body, during which inertia could happen. The kinodynamic input for the system control input is the difference between steering angular changes in which representing front wheel angular changes. This proposed dynamic control strategy is verified by simulating the derived impedance control on RT4WV system model with road terrain and aerodynamic frictions as disturbances. The result shows that the proposed impedance control able to reduce the inertia forces via shaping the steering angular input to the vehicle although there have both road terrain and aerodynamic frictions, especially in cornering tracks.

Keywords Rack steering four wheels vehicle · Inertia control · Compliance · Impedance control · Motion control