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Abstract:

This article presents a robustness analysis study for the model reference controller ("MRC") of active suspension system. The MRC employs both suspension look-ahead preview and wheelbase preview concepts. The methodology of the MRC is based on the ideal hybrid skyhook-groundhook scheme. A 13 degree of freedom full vehicle model is developed and validated. The engine mass, driver seat, and anti-roll bar are considered in the model. The MRC strategy uses eight proportional-integral-derivative (PID) controllers for both body and wheel control. A gradient based on optimization algorithm is applied to obtain the controller parameters using a cost function including both ride comfort and road holding performance. The robustness analysis of the controller is performed by evaluating the MRC controller performance under different driving conditions, including different road profiles, different vehicle speeds, and different vehicle loading. Furthermore, the effect of the variable design parameters of the suspension system is also investigated. The results showed that the MRC for active suspension provides robust and significant improvement in both ride comfort and road holding performance of the vehicle under different operating conditions.