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Implementation of Model Reference Adaptive Control in Tuning of Controller Gains for Following-Vehicle System with Fixed Time Headway

Authors : Fatemeh Behbahani, Rubiyah Yusof

Abstract : To avoid collision between following vehicles and vehicles in front, it is vital to keep appropriate, safe spacing between both vehicles over all speeds. Therefore, the following vehicle needs to have exact information regarding the speed and spacing between vehicles. This project is conducted to simulate the tuning of controller gain for a vehicle-following system through the selected control strategy, spacing control policy and fixed-time headway policy. In addition, the paper simulates and designs an adaptive gain controller for a road-vehicle-following system which uses information on the spacing, velocity and also acceleration of a preceding vehicle in the proposed one-vehicle look-ahead strategy. The mathematical model is implemented using Kirchhoff and Newton's Laws, and stability simulated. The trial-error method was used to obtain a suitable value of controller gain. However, the adaptive-based controller system was able to optimize the gain value automatically. Model Reference Adaptive Control (MRAC) is designed and utilized and based on firstly the Gradient and secondly the Lyapunov approach. The Lyapunov approach considers stability. The Gradient approach was found to improve the best value of gain in the controller system with fixed-time headway.

Keywords : one-vehicle look-ahead, model reference adaptive, stability, tuning gain controller, MRAC
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