Model Reference Adaptive Control Based on Linear Quadratic Regulator for a Vehicle lateral Dynamics

The paper presents a control scheme based on Model Reference Adaptive Control (MRAC) and Linear Quadratic Regulator (LQR), in order to control the vehicle lateral dynamics. Uncertainty in the automotive control systems causes control objectives not to be achieved properly. One of fundamental problems in control systems is the ability to achieve good performance indices in the presence of uncertainties. This paper aims to control the vehicle in the presence of unknown parameters, to enhance system performance. It can be seen that a design based on LQR has a satisfactory tracking regardless of uncertainty, but it cannot handle unknown parameters applied on the vehicle and loses its control effectiveness. Simulation results show that by adding adaptation to the system, the uncertain part is estimated and integrated controller (incorporated LQR and MRAC) has been successful in the presence of unknown parameters. Indeed, by changing matching conditions, the adaptive control can adjust control laws so that the steering performance with unknown parameters such as automobile mass or speed variations is improved significantly.

MRAC, vehicle lateral dynamics, uncertainty, LQR controller

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