continuously reinforced. The maximum tracking error observed was 0.0635 m (0.2 ft) and occurred both when a sidewind was present and when the vehicle entered a curving section of roadway.

the influence of the lateral control system on the design of the guideway is indicated.

OPTIMAL LATERAL CONTROL FOR DUAL-MODE VEHICLES

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The lateral guidance problem for automated highway vehicles on an essentially straight roadway is considered in the light of optimal control theory. An optimal system regulator was designed by using a simple fourth-order, seven parameter, linear model of vehicle lateral dynamics and a quadratic performance index that penalizes both the vehicle's lateral displacement from the desired path and the vehicle's lateral and yaw accelerations. The initial condition response dynamics of the controlled model were investigated, and the importance of considering the vehicle's yaw acceleration when designing the regulator is shown.

Putting the model and regulator problem in dimensionless form reduced the number of independent vehicle parameters to four. The coefficients of the linear feedback law relating the vehicle's front-wheel steer angle to the model state variables are presented in dimensionless form for an extensive range of the four vehicle parameters. For a specific vehicle, the longitudinal velocity is the only parameter that varies significantly. However, the effect of longitudinal velocity on the feedback coefficients is accurately approximated by simple functions. These results are illustrated in the paper for a typical sedan.

LATERAL CONTROL OF DUAL-MODE VEHICLES

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The General Motors dual-mode vehicle is controlled laterally in the automatic mode in three ways. Primary guidance is achieved through front-wheel steering in a response to vehicle-borne computer control. Cables buried in the guideway surface generate a magnetic field for lateral reference. Vehicle-mounted antennae measure the deviation from the desired path, and the computer converts this signal to a steering correction signal, which in turn is magnified hydraulically in the steering mechanism. An independent mechanical backup, consisting of a vehicle-mounted arm and a slot in the guideway surface, is provided for positive switching in the diverge areas. The design of the guideway walls provides a second backup for lateral vehicle restraint.

The effects of feedback paths, control system design, and vehicle dynamics on disturbance response and path following are discussed. Vehicle directional control characteristics necessary for automated steering are described. The effects of selected component failures on vehicle lateral control are shown in the paper, and