Abstracts of Papers

LONGITUDINAL CONTROL SYSTEM FOR DUAL-MODE TRANSIT SYSTEM OF GENERAL MOTORS

Roy Farmer and Frank Rumreich, Delco Electronics Division, General Motors Corporation
Ronald Smisek, Transportation Systems Division, General Motors Corporation

This paper discusses the longitudinal control system currently being developed by General Motors for use in the dual-mode transit system development program sponsored by the U.S. Department of Transportation. The longitudinal control system is considered in two functional areas: vehicle management and vehicle control. Synchronous and asynchronous vehicle management systems are evaluated, and the advantages and disadvantages associated with each technique are compared with their impact on management computer requirements, trip time, and system use. A synchronous slot concept was chosen as a logical first step in the development process because of its relative ease of implementation. Advantages associated with the adaptability of asynchronous vehicle management are outweighed by the complexity of asynchronous merge requirements.

The vehicle longitudinal control system being developed is a point follower; that is, each vehicle is constrained to remain in an assigned, moving, synchronous slot determined by the vehicle management system. A dual-mode vehicle was modeled and incorporated into a digital simulation containing a number of candidate guidance schemes controlling both throttle and brake actuators. With the aid of simulation results, guidance options are evaluated on the basis of on-board versus off-board equipment requirements, spacing and type of guideway benchmarks, and accuracy and response in the presence of abnormal operating conditions. Several options appear attractive.

Further effort in this area should consider controller refinements that allow more precise influence over parameters related to passenger comfort. Another area for future effort might be to determine a method of optimally selecting velocity command profiles based on known vehicle dynamics.

REFERENCE SIGNAL FOR SYNCHRONOUS LONGITUDINAL CONTROL

R. J. Mayhan and R. E. Bailey, Department of Electrical Engineering, Ohio State University

One method of continuous reference signal generation for synchronous longitudinal control was previously investigated, its feasibility established, and several difficulties associated with its practical implementation defined. These difficulties, encountered with signals at 3.75 MHz, were excessive attenuation and variable propagation characteristics. The former limits operation to short distances, while the latter results in unexpected and undesired changes in slot length.

These difficulties can be partially alleviated by operating at a lower frequency (e.g., 450 KHz), according to the results of tests reported in the paper. The attenuation was greatly reduced, 0.25 versus 2.3 db/30.5 m (100 ft), but essentially no improvement in the variability of the propagation characteristics was noted. Operation under wet road conditions produced a significant increase in the attenuation—1.4 versus 0.25/30.5 m (100 ft)—and resulted in nearly a 50 percent change in the slot length.

This method of reference signal generation would be most practical for those dual-mode systems that use environmentally protected guiding structures. However, localized use (e.g., in merging operations) would readily be accomplished without the use of protected structures provided that environmental sensing were used to allow for compensating adjustments in the signal parameters.

BRAKING SYSTEM INTEGRATION IN DUAL-MODE SYSTEMS

Jeffrey J. Bowe, Transportation Systems Center, U.S. Department of Transportation

There are many interrelations of significance for properly integrating a braking function into a dual-mode transportation system. Factors shaping the characteristics of the braking system are its interfaces with other vehicle systems. The braking system must be compatible with power and propulsion systems and with command and control functions. The operational parameters of motion—headway, velocity, deceleration, and jerk limits—constitute, of course, another set of determining factors.