IMPROVED CRUISE CONTROL FOR FUEL ECONOMY AND DRIVER’S SAFETY FEELING

R. Alves*, C. Ferreira, T. Fernandes
ESTG, Instituto Politécnico de Leiria, Portugal

Keywords

Cruise control, Fuel economy, Vehicle safety

Objective

A generic cruise control system objective is to maintain the vehicle velocity, defined by the user, as constant as possible. The concept was kept simple over the years, most recently, research on developing systems which, can reduce the vehicle fuel consumption by knowing of roads topology or wheel torque constraints, has been carried on. Also, an insecurity feeling has been reported by cruise control users, namely when driving on curves and downhill. Therefore, the objectives of the presented work are: to study the benefits of small adjustments of the vehicle velocity in the fuel consumption, and to evaluate the behaviour of driver’s, regarding the vehicle velocity, under lateral accelerations.

Methodology

The fuel supply system of a test vehicle was modified for the precise measurement of its fuel mass consumption (through a precision scale). Trials for multiple loads and engine revolutions were made, using a chassis dynamometer, to determine the vehicle fuel consumption map. Were developed algorithms to control the vehicle velocity while make the engine operating at its best efficiency. Multiple routes were tested, with the test vehicle at constant speed and with the velocity controlled by the developed algorithms, and results were compared.

To determine driver’s typical behaviour, accelerating response, under vehicle lateral acceleration. Test vehicles were equipped with an acquisition system which measures tri-axial accelerations and the vehicle velocity via its OBD connection. Several vehicles were drove on highways, by multiple drivers, with the standard cruise control system (constant velocity) turned ON and OFF. The driver's behaviour with the cruise control system turned OFF was characterized.

Results

Tests showed that using the developed algorithms to adjust the vehicle velocity it is possible to reduce the vehicle fuel consumption around 5% while keeping the same travelling time, or, alternatively to reduce the fuel consumption by 11% at the expense of the travelling time (increased by 10%).

Regarding the driver normal behaviour (without cruise control), in general, it was noticeable a vehicle longitudinal deceleration as a function of the magnitude of the lateral acceleration. This behaviour can be programmed/reproduced by the velocity control system to improve the driver feeling of safety and to eliminate undesirable panic reactions.

Conclusions

Actually, when vehicle manufactures are developing new technologies to reduce fuel consumption and to improve on board safety, a redefined cruise control with variable vehicle velocity makes a lot of sense. This work proves that is possible to reduce fuel consumption, while keeping travelling time acceptable. Moreover, the natural behaviour of driver’s under moderate/high vehicle lateral acceleration can be reproduced by the cruise control system, eliminating driver’s unsafe feeling, which can lead to panic/invasive reactions. To our best acknowledge, it is the first time such a system with an undeniable contribution to vehicle’s fuel economy and safety is proposed.