ADAPTIVE REGULATOR FOR ANTILOCK BRAKING SYSTEM

Andrei Plaian, Felicia Ursu
National Institute for Aerospace Researches
Bdul. Iuliu Maniu 220, sector 6, Bucharest, ROMANIA
tel.401-413.50.00/251, fax: 01-312.53.41,
e-mail: iursu @ aero.incas.ro

Key words: Vehicle control, adaptive control, antilock bracking system, mathematical modelling, numerical simulation.

In recent years a large amount of work has been invested in solving the practical problem of designing regulators for vehicle's antilock braking system (ABS). The main problem is to obtain a good estimation of the vehicle's speed, which can be reduced through the state equation of the vehicle to the equivalent problem of estimating the friction force between the wheels and the surface of the road.

This study presents a new procedure of estimating the friction force, using only the measurement of the angular speeds of the wheels.

Considering this idea, we built an ABS regulator and tested its performances through numerical simulations. The decision of changing the braking pressure is based on four critical values, two values of angular acceleration and two values of slip ratio. The critical values are changed during the braking process according to the magnitude of the estimated friction force.

The numerical simulations were made for different types of roads, characterised by experimentally obtained evolution of the friction coefficients depending on the slip ratio of the wheel, which were previously linearised for simplicity purpose.

We have considered a simplified model of the vehicle, assuming that values of the state variables are identical for the two wheels situated on the same axle. Therefore, the numerical simulation shows only the evolution of the real vehicle speed V, the angular speeds of the front axle V_f and the rear axle V_r, and the corespondent slip ratio S_f and S_r.

In fig.1. is presented as illustration some of the results concerning the time evolution of the mentioned variables. Two types of roads were considered in these graphics. The numerical simulations made for many other types of roads shows that the slip ratio remains in acceptable limits during the braking process.

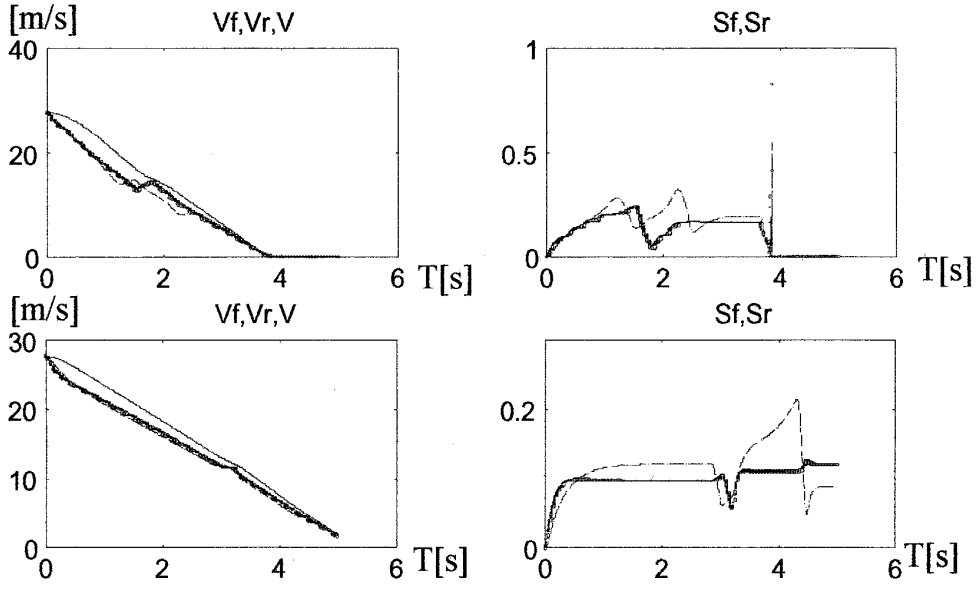

Fig.1. Time response of the ABS on two types of roads