

Effective Vehicle Sideslip Angle Estimation using DVS Technology

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Abstract - The vehicle sideslip angle is one of the most important variables for evaluating vehicle dynamics. The potential value of such a variable for obtaining significant improvements over current stability control systems is widely recognized. However, its direct measurement requires the use of complex and expensive devices which cannot be used in production cars.

Large research efforts has been devoted to the problem of estimating the sideslip angle from other variables currently measured by standard Electronic Stability Control (ESC) sensors. However, at the best of author's knowledge, until now no application to production cars is known.

In this paper, a new sideslip angle estimation technology is presented. Based on the innovative DVS methodology recently developed by the authors, a software algorithm, indicated as DVS/SA (Direct Virtual Sensor of Sideslip Angle), is designed, which estimates the sideslip angle from measurements of the yaw rate, lateral and longitudinal acceleration, wheel speed, steering angle, available from ESC sensors of most present production cars. The key innovative idea of the technology is that the DVS/SA is directly designed from the experimental data collected from a testing car, subject to suitable manoeuvres in different road and load conditions. One of the distinctive features obtained by this new approach is that good estimation accuracy is achieved even for quite large operating condition variations, e.g. dry or wet road, different tire status, etc. The effectiveness of the DVS/SA technology is evidenced not only by the experimental results presented in the paper but also from the fact that it has been recently made available on a top class car.