Exponential Decay of Contact-Patch Friction Steering Moment with Rolling Speed

Jai Prakash[1,2]
Michele Vignati[2]
Edoardo Sabbioni[2]

Steering torque is a very important quantity for the driver feeling. In fact, it gives the driver an idea of the road adherence condition while driving the vehicle. Several models are available in literature to simulate shear forces at the contact patch, most of them are based on semi-empirical tire models that account for tire slip and slip angles. They have good reliability when speed is medium and high. At very low speed, like in parking maneuvers, these models suffer from both reliability and numerical issues. This paper presents a model to compute the steering moment due to contact-patch friction at any longitudinal speed including pivot steering condition. In particular, it supplements the pivot steering model with a novel exponential decay of moment model to simulate various rolling speeds of the wheel. The decay rate of steering moment found to be dependent on contact-patch geometry and rolling speed. The steering moment obtained with the proposed model can be combined with self-aligning moment obtained from the slip based empirical models to obtain the net steering moment.

[1] Corresponding Author jai.prakash@polimi.it

[2] Assistant Professor, Mechanical Department, Politecnico Di Milano, Italy