

Master Thesis

Modeling of Tire Grip Force & Abrasion Performance Considering Temperature Effects

Background

In the forthcoming autonomous driving state, a precise estimation for tire grip force is quit important. Meanwhile, if we had an accurate wear model to normalize the wear behavior of tire in different conditions, tire lifespan is expected to be prolonged by an optimal operating strategies, which can be ensured by the technology 'vehicle to everything (V2X)'. However, tire grip force & abrasion are influenced by many factors, e.g. contact pressure and temperature of tire etc. And tire temperature may vary in different driving conditions. This variation of temperature will not only affect the friction force but also change the anti-abrasion abilities of rubber. Till now, there is not many well developed tire models considering those factors comprehensively. Especially regarding to the influences of tire temperature rise effect on tire wear performance. It is practically meaningful to investigate this topic and work out tire model to predict tire performance more accurately.

Expected goals

- Work out a method to describe the influence of rubber temperature on tire grip force & abrasion performance.
- Complete the existing GAT (Grip and Abrasion Test Bench) tire model (based on Grosch wheel and is valid for wheel shaped rubber samples). Then translate it into a full size tire model. With the given driving conditions (e.g. load, slip angle, speed, ambient temperature etc.), the final model should be able to present the friction force, temperature status and abrasive mass loss of tire.

Planned works

- Do literature research and gather the information about how to show the impact of temperature rise on tire grip force & abrasion performance, e.g. Williams–Landel–Ferry equation (WLF).
- Modify the existing GAT tire model (has already been developed with MATLAB code and is able to predict tire force & temperature rise roughly) and enable it to show the influence of temperature on tire grip force. Besides, calculate tire wear with considering the temperature impacts.
- Perform measurements (force & wear) on GAT and validate the model.
- Translate the GAT tire model into an actual full size tire model.

Requirements.

- Good at programming with MATLAB, and familiar with tire dynamics
- Good sense of projects management (e.g. organize measurements on GAT)

Start: Since now

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