



## Ph.D. Thesis MICHELIN /

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**Title:** Estimation for vehicle tire-road interactions towards automated driving

### **Lab and company:**

A fully funded Ph.D. position is available at Michelin and the Laboratory for Computer Science and Automation Systems (LIAS), Poitiers University, France. The appointment will be for 3 years.

### **Summary:**

During the next half century, the development of new information and communication technologies tools should enable cars to be operated in a fully autonomous mode as well as in a combined human-machine mode (better than the one we currently know). In this context, future cars will be more and more based on innovative control algorithms to ensure autonomous functions, to improve car performance, to optimize occupant comfort and, more importantly, to increase passenger as well as pedestrian safety. Current algorithms used for trajectory control, braking assistance, avoidance maneuvers, are all based on use of so-called observers which enable to estimate vehicle dynamical states as well as tire efforts and tire/road friction coefficient. Tire efforts estimation are generally based on empirical models or simplified physics based models. Those models enable accurate effort estimations. However, they do not include a model of the thermal behavior of the tire and thus have no information about the tire state. A direct consequence is that, whereas they can estimate the value of the road/tire friction limits, these observers cannot establish if the estimated variations result from road surface changes or from evolutions of the rubber properties due to thermal effects.

The main objective of this Ph.D. thesis is to develop new tools for monitoring road changes on real cars. This project aims at providing new solutions to avoid the aforementioned drawbacks and develop new control algorithms for Automated Driving Systems, leading to an increased safety for the end users. In order to reach this goal, a specific attention will be paid to the development of new algorithms for road friction change estimation, i.e., the development of new tire models in order to (i) estimate possible evolutions of road conditions (ii) study its real time behavior when road conditions evolve, (iii) develop flexible models for modern ADS design.

The developed estimation methods will be developed thanks to simulated data based on accurate vehicle and tire physical models available at Michelin. During the Ph.D., test plan will also be designed and performed at the test tracks of Michelin R&D center in Ladoux, France, in order to validate the developed approaches with real data.

### **Candidate requirements:**

Applicants should have a Master's degree from a good-quality university in applied mathematics, engineering, computer science or a related field. They should possess a strong background and interest in mathematics and, ideally, in system identification and advanced control. They should have excellent analytical and problem solving skills and, preferably, well-developed programming skills. Applicants should



have a good knowledge of Matlab. The candidate should have excellent oral and written communication skills in English.

**Application procedure:**

To apply for this Ph.D. position, send email to [guillaume.mercere@univ-poitiers.fr](mailto:guillaume.mercere@univ-poitiers.fr) and [jeremy.vaysettes@michelin.com](mailto:jeremy.vaysettes@michelin.com) with subject "estimation for vehicle tire-road interactions towards automated driving", attaching an academic CV, a cover letter, a pdf of your diplomas and transcript of course work and grades, a certificate of proficiency in English, and any other document deemed necessary by the candidate which can enrich the application.