**Ph.D. in Information Technology: Thesis Defenses**

**January 28th, 2021**

**online by Teams – at 9.30**

**Alessandra DUZ – XXXIII Cycle**

"Eco-efficient smart mobility: a focus on the human factor"

Advisor: Prof. **Matteo Corno**

**Abstract:**

Smart mobility provides eco-efficient solutions for human locomotion, through the active control of energy sources and vehicle dynamics. The shifting towards this type of transportation systems determines a change in the role of the human subject as a driver and consequently calls for a redefinition of the methods to deal with the human perception of ride quality. My dissertation presents three eco-efficient smart mobility solutions, which are developed with a focus on the human factor. Each solution investigates a specific type of engagement of the person. First, I propose a computationally efficient speed planner for fully autonomous driving systems. The developed algorithm optimizes a tuneable trade-off between energy consumption and passenger comfort, where the latter considers a novel frequency-based evaluation of comfort and motion sickness incidence. Additionally, the description of motion sickness incidence is enhanced through the experimental identification of models for the passenger's head dynamics. The second solution investigates the energy management of power-assisted cycles, I analyze the usage of hybrid bicycles in the context of a bike-sharing free-floating service. I propose a motor control strategy to tackle simultaneously the stabilization of the long-term system energy dynamics and the improvement of the cycling experience, by exploiting the gaps of the cycling efficiency. The result is a user-adaptive control that obtains the energetic and economic sustainability of the service. Finally, the dissertation considers the enhancement of human mobility through the supervision of the body status, specifically I analyze the potential of a novel wearable sensor for respiratory measurements in the identification of the energy optimal run gait of an athlete.

**Dario SAVARESI – XXXIII Cycle**

"Control Oriented Learning in Vehicles"

Advisor: Prof. **Simone Formentin**

**Abstract:**

With the rapid growth of the population, the number of vehicles is also going to increase, to answer the raising demand for a more performing, comfortable, and safe mobility, focused both on leisure and working activities. For such a reason, a huge effort has been put in researching and developing new solutions, to be applied to the variety of means of transport that are available nowadays. A significant amount of time has been devoted from the mechanical and control system design point of view. Most of these control problems assume on-board measurement are available. In many scenarios, however, this is not the case. In this perspective, the objective of this thesis is to propose solutions for some vehicle-oriented estimation problems, developed for different classes of vehicles and in order to be able to deal with the subsequent implementation of appropriate control strategies, which cannot be taken into account without this preliminary discussion. The work is carried out considering three main categories of vehicles: heavy-duty vehicles (in particular agricultural tractors), cars, and bicycles. These three types of vehicles are well representative of the characteristics, the problems and the different solutions that can be adopted to solve the points at issue. Each one of the main estimation research lines is investigated: the mass estimation for an agricultural tractor is a paradigmatic example of parameter estimation. An algorithm for continuously monitoring the shock absorber state of health well represents the fault detection and recovery topic. Tightly linked to this field there is that of safety critical systems, whose example is represented by a Brake by Wire application for bicycles, actuated by a DC Brushless motor, with possible issues in retrieving the rotor angle. Finally, the optimal shifting point for a bike is obtained from the available sensors, as an example of signal reconstruction and virtual sensing.

**PhD Committee**

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