


MSc. Assignment	Active stability control for a bicycle	
Key words	Bicycle, manual control, mechatronic design	
Introduction	<p>The TU Delft bicycle lab (3mE/PME) investigates driver bicycle interaction in order to improve bicycle safety, comfort and performance.</p> <p>Recently a prototype of a steer-by-wire bicycle has been developed. The steer-by-wire system replaces the mechanical connection between the handlebars and the steered front wheel assembly by sensors, actuators and a controller. The system is capable of actuating both the steer and the handle bars (feedback torque) from the measured state of the complete bicycle system. The underlying control model is based on the linearized equations of motion of the bicycle. At low forward speed a normal bicycle is unstable. With the sensors and actuators on board of the steer-by-wire bicycle an active stability program can be implemented in the controller and make the bicycle stable at low speed.</p>	
Project	<p>The objective of the proposed MSc assignment is: "To develop an optimal control strategy stabilizing the bicycle at low speed"</p> <p>Address the following questions</p> <ul style="list-style-type: none"> - How does the rider perceive this enhanced stability? - Can you measure the change (decrease) in control effort from the rider? - How does the stability enhancement influence the maneuverability? - Is there a trade-off between stability, handling and maneuverability? 	
Project phases	<p>The candidate will start by studying literature on bicycle dynamics, feedback control systems, steer-by-wire, force feedback and haptic systems. Go over the current design of the steer-by-wire bicycle; understand its design and operation. Next he will use control theory and simulations to design an optimal controller, implement the controller and perform human in the loop experiments to address the above mentioned research questions.</p>	

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