


MSc. Assignment	Steer-By-Wire Bicycle	
Key words	Bicycle, Steer-by-wire, control, mechatronic design	
Introduction	<p>Recently a prototype of a steer-by-wire scooter was developed at the TU Delft faculty of IO. Both the control algorithm and the mechanical design of the steer-by-wire system were sub-optimal, making the scooter difficult to control. Among other things, the steer actuator design prohibited the front wheel from freely rotating about the steering axis, thereby preventing the possibility of the machine showing any form of dynamic selfstability.</p> <p>The bicycle dynamics lab is interested in equipping a bicycle with a steer-by-wire system to create a variable stability bicycle. This variable stability bicycle can then be used to do all kinds of bicycle handling quality experiments.</p> <p>The desired steer-by-wire system replaces the mechanical connection of the handlebars with the front wheel by sensors and actuators. The system should be capable of actuating the steer and the handle bars (feedback torque) given the measured state of the complete bicycle system. The underlying control model is then based on the linearized equations of motion of the bicycle together with a stabilizing or destabilizing controller.</p>	
Project	<p>Model, design, manufacture and test a steer by wire system for a bicycle. Key aspects to be taken into account in the design include:</p> <ul style="list-style-type: none"> • Retaining the bicycles ability to selfstable. • Enable multiple control algorithms to control both the steering of the wheel and the handlebars. <p>Minimize the time delay between handle bar rotation and the applied steer torque and feedback torque.</p>	
Project phases	<p>The candidate will start by studying literature on bicycle dynamics, feedback control systems, steer-by-wire, force feedback and haptic systems. Carry out a system requirements study before making a mechanical and control model and design. Finally the mechanical design will be produced, the control implemented and the system tested and evaluated.</p>	

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