

## MSc project

# Bicycle Dynamics and Control



One of the great mysteries in bicycle dynamics and control is the question: "how do we stay on track". Since a bicycle is mostly unstable the control task is two-fold: stabilizing and path following. The stabilizing task is clear: do not fall over. The path following is not. Some researcher see this path following problem as a 'stay on the track' problem but this makes the task too restrict since we usually have the whole width of the bike path for usage.

Therefore we wish to develop a controller model which, for a given forward speed, stabilizes the bicycle and keeps it within the bounds of the bike path at minimal control effort. This controller can easily be implemented together with the currently available dynamic model of a bicycle [1] into a complete dynamic systems control model.

This controller model can then be validated by means of field experiments on the open road. The necessary measurement equipment is readily available [2].

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[1] J. P. Meijaard, Jim M. Papadopoulos, Andy Ruina, A. L. Schwab, 2007 ``Linearized dynamics equations for the balance and steer of a bicycle: a benchmark and review," *Proceedings of the Royal Society A* **463**:1955-1982. [doi:10.1098/rspa.2007.1857](https://doi.org/10.1098/rspa.2007.1857), or [preprint+ESM pdf\(578k\)](#).

[2] Kooijman, J. D. G., Schwab, A. L., and Meijaard, J. P. (2007). ``Experimental validation of a model of an uncontrolled bicycle," *Multibody System Dynamics*, Online First version [pdf\(589k\)](#)