

Acquisition of Performance Parameters in Race-Bike Training

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Abstract

The goal of our Power-Bike-Project is to develop methods for data acquisition, analysis, and visualization of performance parameters in endurance sports with emphasis on competitive cycling. Measurements from a palette of devices, including common bike computers, GPS-recorders, and power meters, shall be combined requiring data fusion and synchronization.

For this purpose we have developed a bicycle simulator based on a [Cyclus 2 ergometer](#) and our own PC-based control software. The main components of the simulation are:

- a computer controlled pedal resistance according to the height profile of a cycling track
- the recording and visualization of training data measurements (speed, cadence, power, heart rate, height profile etc.)
- and a video display of the cycling track that shows the current position.

This allows the measurement of training parameters in a laboratory environment, where we want to familiarize cyclists with unknown cycling tracks to an extent that allows competitive performance on that track.



The Cyclus 2 ergometer



Screenshot of our simulation software

Given the necessary parameters, the Cyclus2 ergometer is able to produce a brake force that comprises forces due to a gradient, air resistance and friction:

$$F_{brake} = F_{grad} + F_{air} + F_{fric}$$

This talk shall explain how this basic model can be used in conjunction with our custom-made software and course data to simulate rides on existing tracks. We present calibration methods and discuss the accuracy of the system.

In cooperation with the sports scientists of the University of Konstanz, we have test persons ride the Schiener Berg both on our simulator and outside in order to answer the following questions:

- How does the performance increase on a specific course?
- Is the simulation realistic and does it improve the outdoor performance?
- Do the displayed indoor parameters help the cyclist?
- Which displays are most effective?

For further information, refer to our [Powerbike Project Webpage](#).

References

M. Fueller. *Datenfusion und Synchronisation*. Bachelor's Thesis, University of Konstanz, 2006

D. Saupe et al. *Analysis and visualization of space-time variant parameters in endurance sports training*. In Proceedings of the 6th International Symposium on Computer Science in Sports (IACSS 2007), 2007.