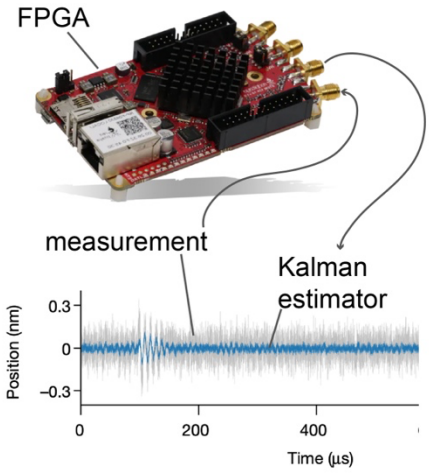
Implementing an optimal control strategy to steer the motion of a levitated particle

Precise control of quantum systems is a fundamental task in many areas of physics, from manipulating single atoms to controlling kilogram-scale pendulums. Optimal strategies for such control rely on recursive Bayesian filters to predict and estimate the state of a quantum system, extending classical Kalman controllers to quantum systems. Recently, these techniques have been successfully applied to cool the motion of optically levitated nanoparticles.

In this project, you will develop a Kalman controller for a levitated nanoparticle and extend it by including all centre-of-mass modes and accounting for non-idealities in the measurement noise. You will design, code and experimentally test the controller using a levitated nanoparticle.

Objectives:

- Apply Kalman control to optomechanical systems
- Electronically implement the controller
- Experimentally test the control strategy to cool the motion of a levitated particle



Prior knowledge: Experience with programming an FPGA is recommended. Familiarity with control theory is a plus, but not required.

Are you interested? Please contact Massimiliano Rossi (m.rossi-1@tudelft.nl) or drop by my office (22.E105)!