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Enhancement of Fabry-Perot cavity-locks using FPGA-based filters

High-finesse Fabry-Perot optical cavities are critical components of modern quantum optics experiments. Cavity locks using feedback can suffer from instability caused by mechanical resonances or other imperfections in the electro-optical system. This instability often leads to unwanted noise in measurements or requires frequent manual intervention. In this thesis, we analyze the feedback loops of different cavity locks, e.g. one built specifically for this investigation and another already integrated into an experiment. Different loop-shaping methods are explored to improve the performance of the locks. A PID controller, an IIR filter, and a FIR filter are implemented on a Red Pitaya FPGA board. We will report on our findings and show preliminary measurements that indicate an overall improvement in lock performance and stability.