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it push the mirrors back, so the differential mode has a positive spring constant and an optical spring at 4.5 Hz for pitch and 4.1 Hz for yaw.

From these results, control band-width is necessary to cover these optical springs at least. In this simulation, it is found that 10 Hz control band-width makes loops stable.

4. Summary

Time domain simulation tool E2E is a very useful tool to investigate interferometer with future parameters to deal with radiation pressure even if a real interferometer does not exist yet. According to this simulation, it is necessary to acquire the lock first with a low input power, and then engage the alignment control while increasing the power to keep the interferometer locked, and optical instabilities and optical springs show up when the cavity is locked with Advanced LIGO laser power. However these instabilities can be controlled by the proper ASC design which controls the test mass by feedback to the penultimate mass.

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