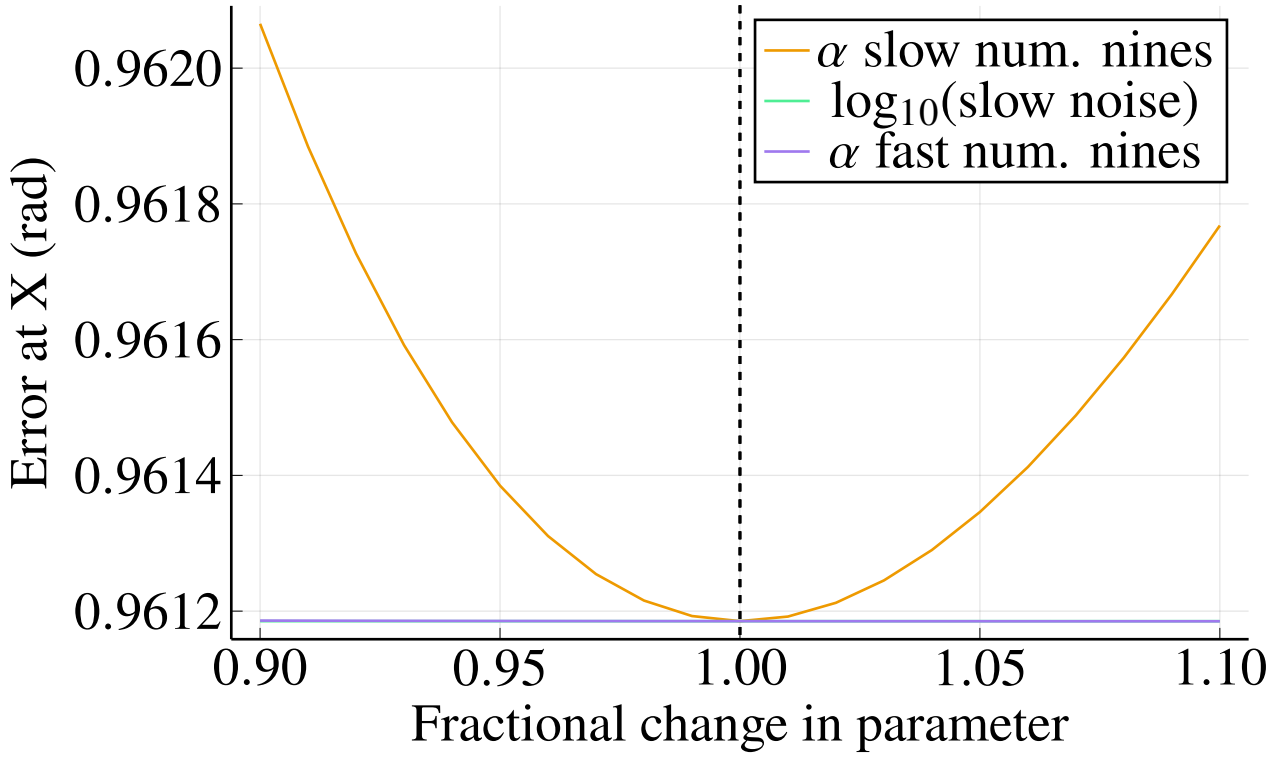
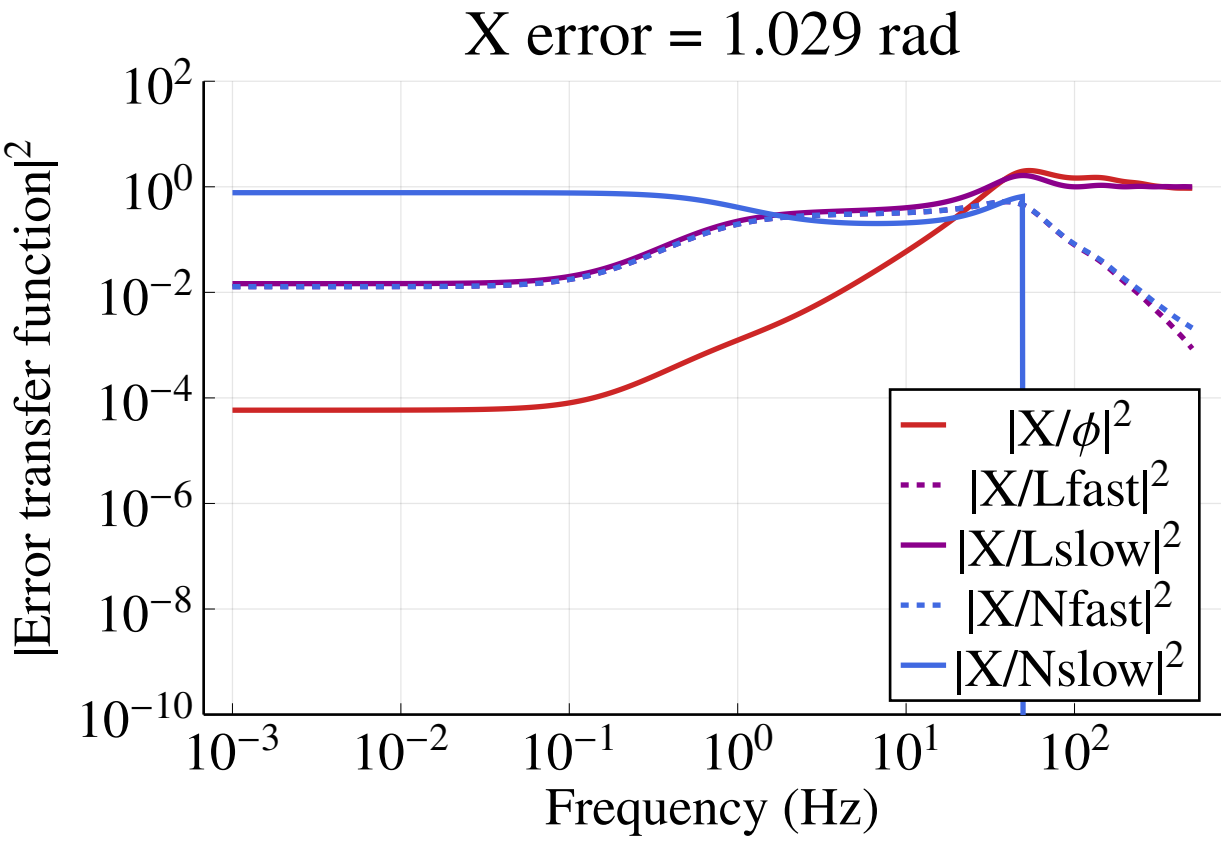
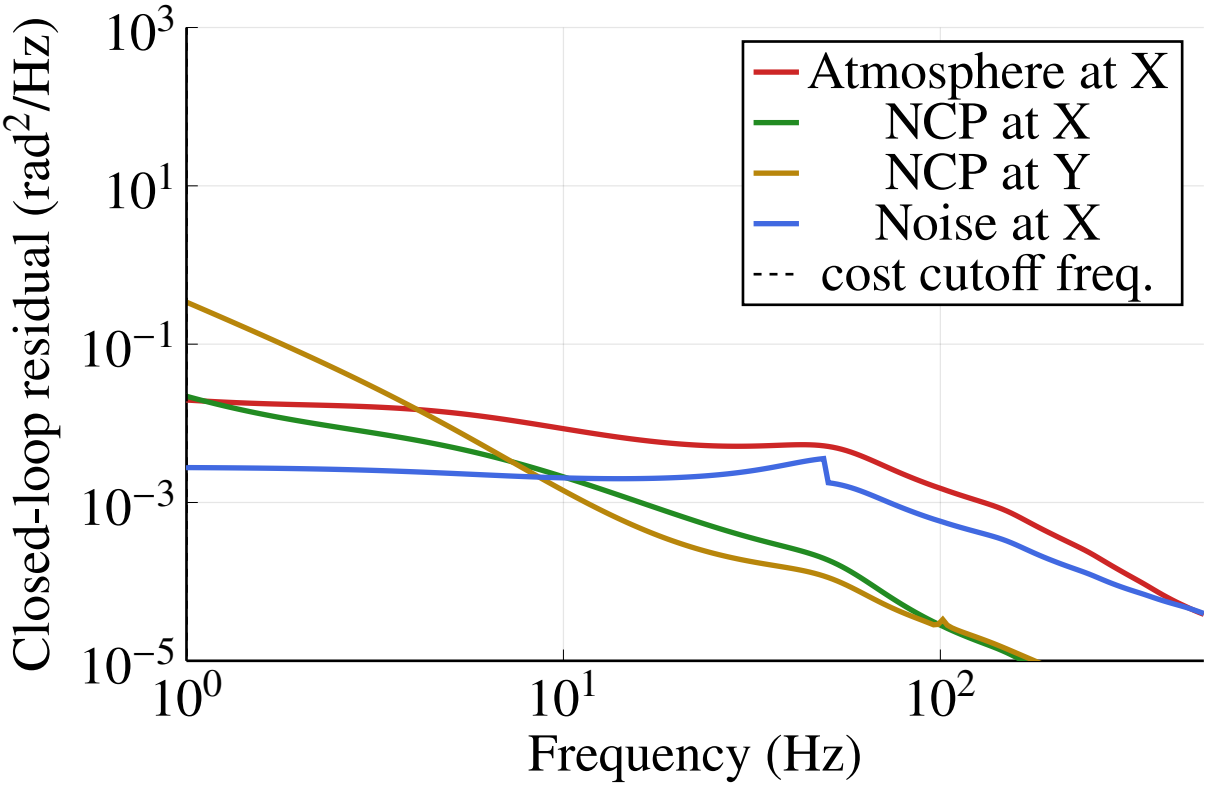
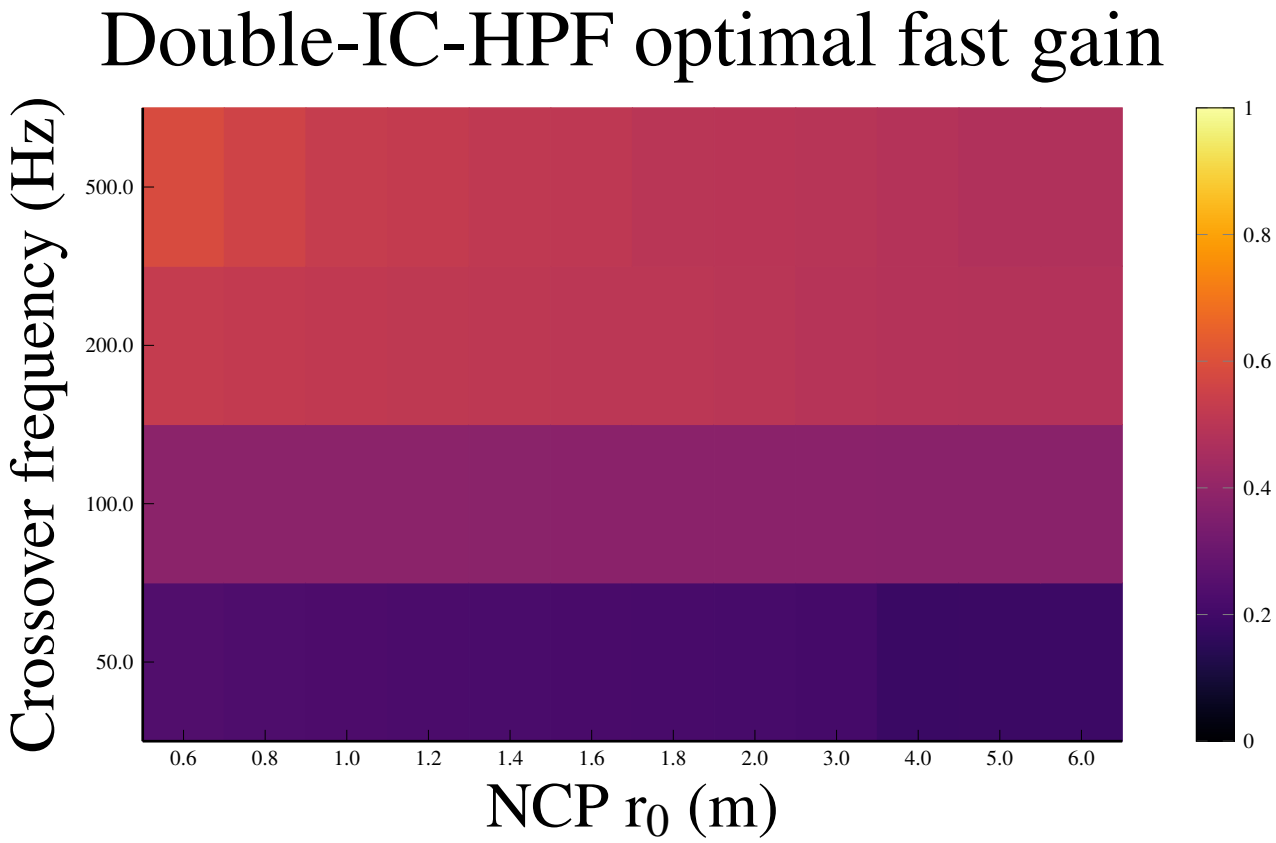
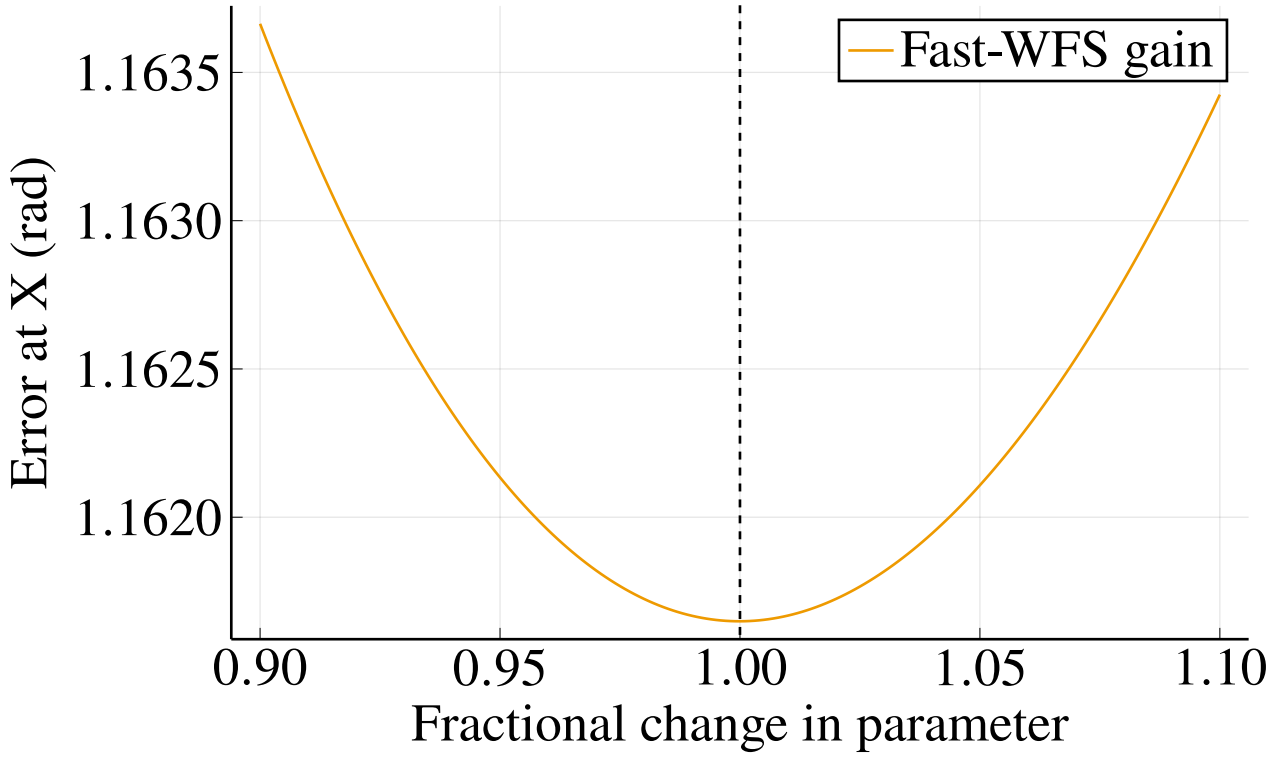

0.9620
0.9618
0.9616
0.9614
0.9612
Error at X (rad)
0.90
0.95
1.00
1.05
1.10
Fractional change in parameter
α slow num. nines
log10(slow noise)
α fast num. nines

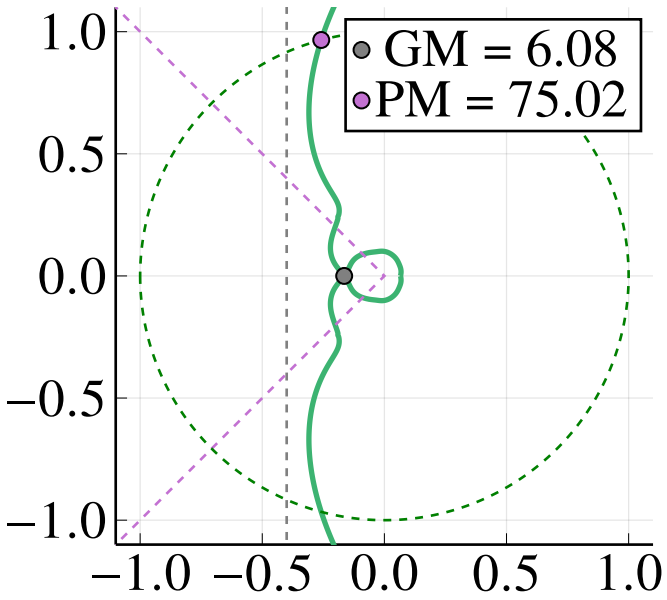
1

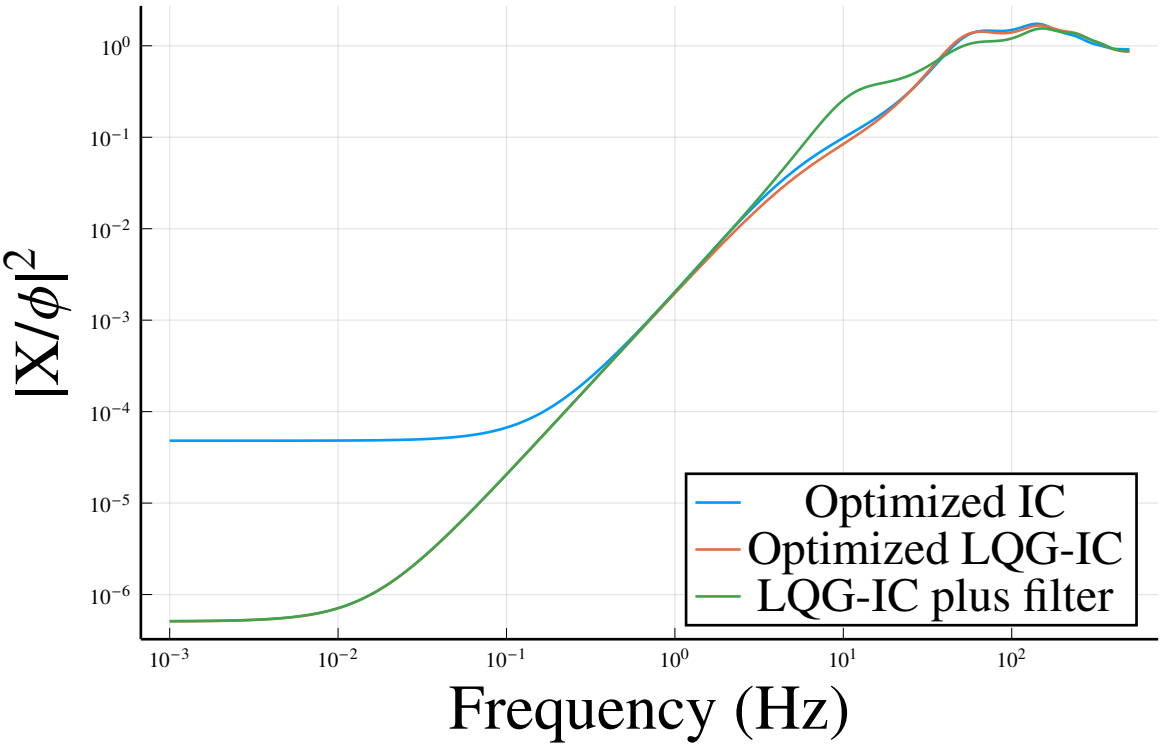

X error = 1.029 rad
|Error transfer function|^2
10^{2}
10^{0}
10^{-2}
10^{-4}
10^{-6}
10^{-8}
10^{-10}
10^{-3}
10^{-2}
10^{-1}
10^{0}
10^{1}
10^{2}
Frequency (Hz)
|X/ϕ|^2
|X/Lfast|^2
|X/Lslow|^2
|X/Nfast|^2
|X/Nslow|^2

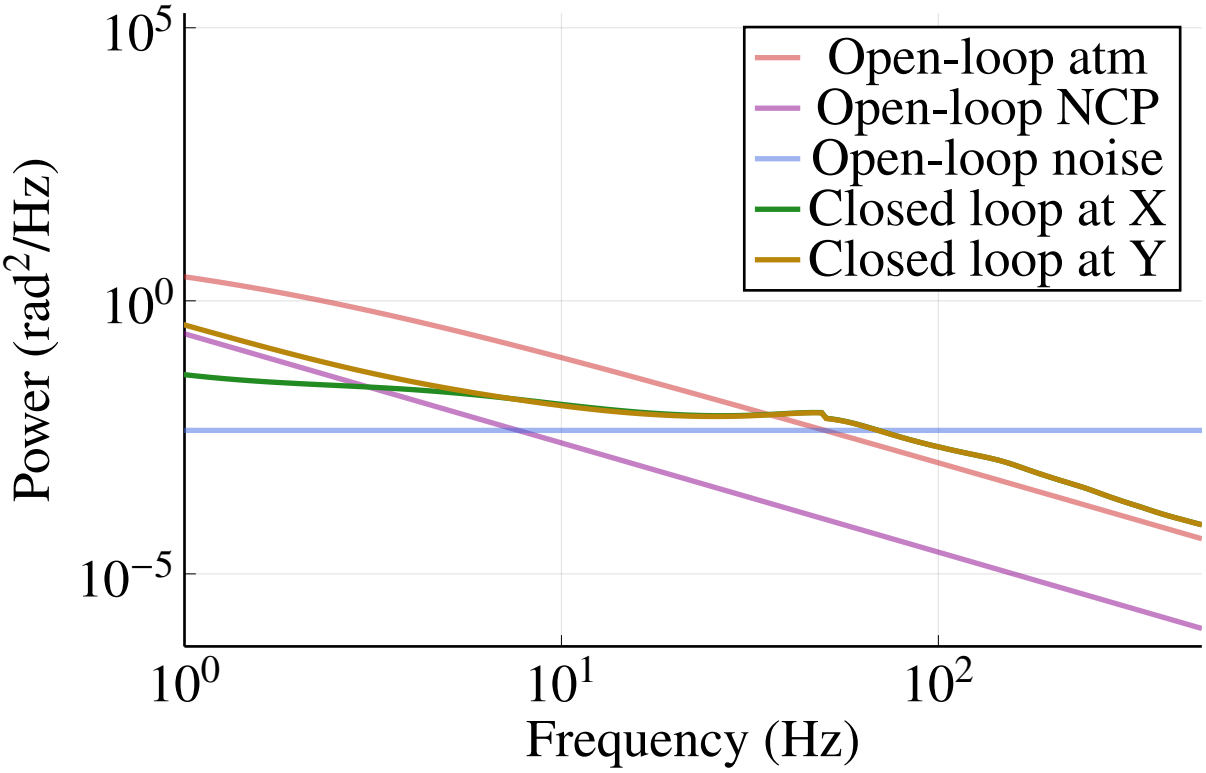

Closed-loop residual (rad²/Hz)
10³
10¹
10⁻¹
10⁻³
10⁻⁵
10⁰
10¹
10²
Frequency (Hz)
Atmosphere at X
NCP at X
NCP at Y
Noise at X
cost cutoff freq.

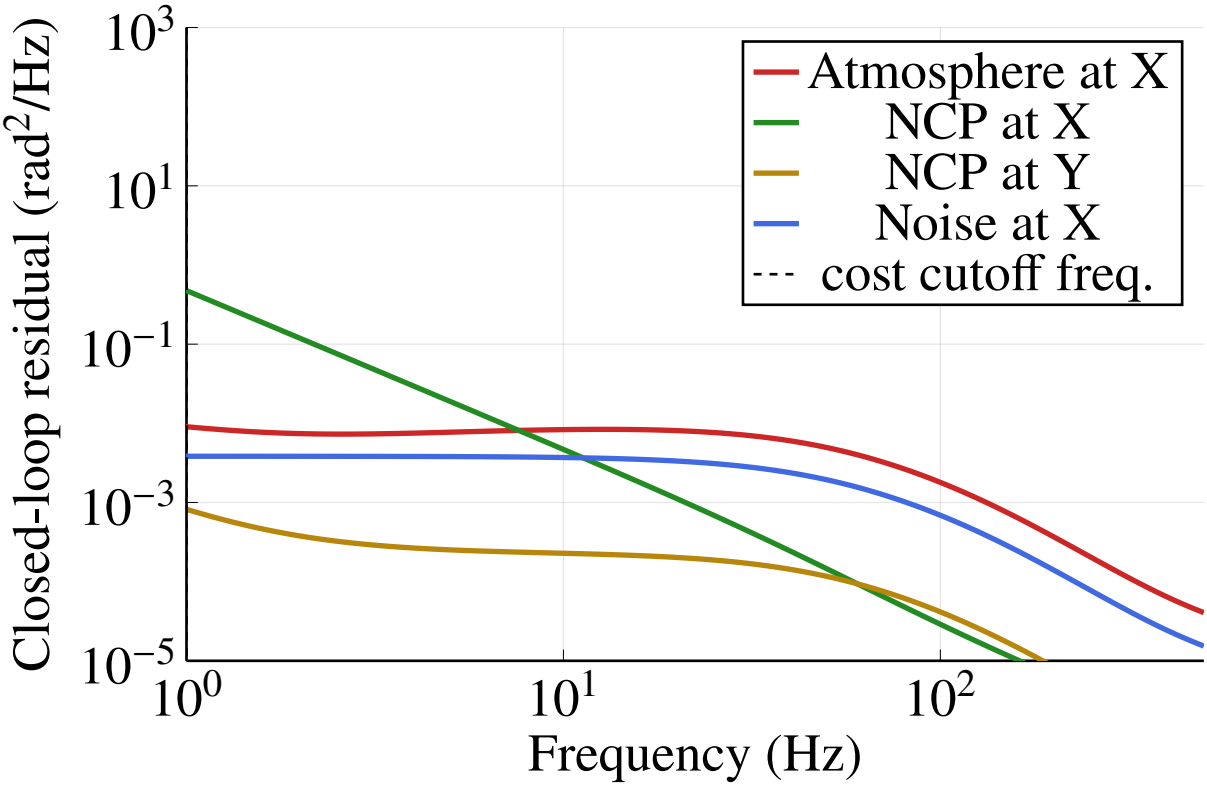

Double-IC-HPF optimal fast gain
Crossover frequency (Hz)
500.0
200.0
100.0
50.0
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
3.0
4.0
5.0
6.0
NCP r0 (m)
1
0.8
0.6
0.4
0.2
0

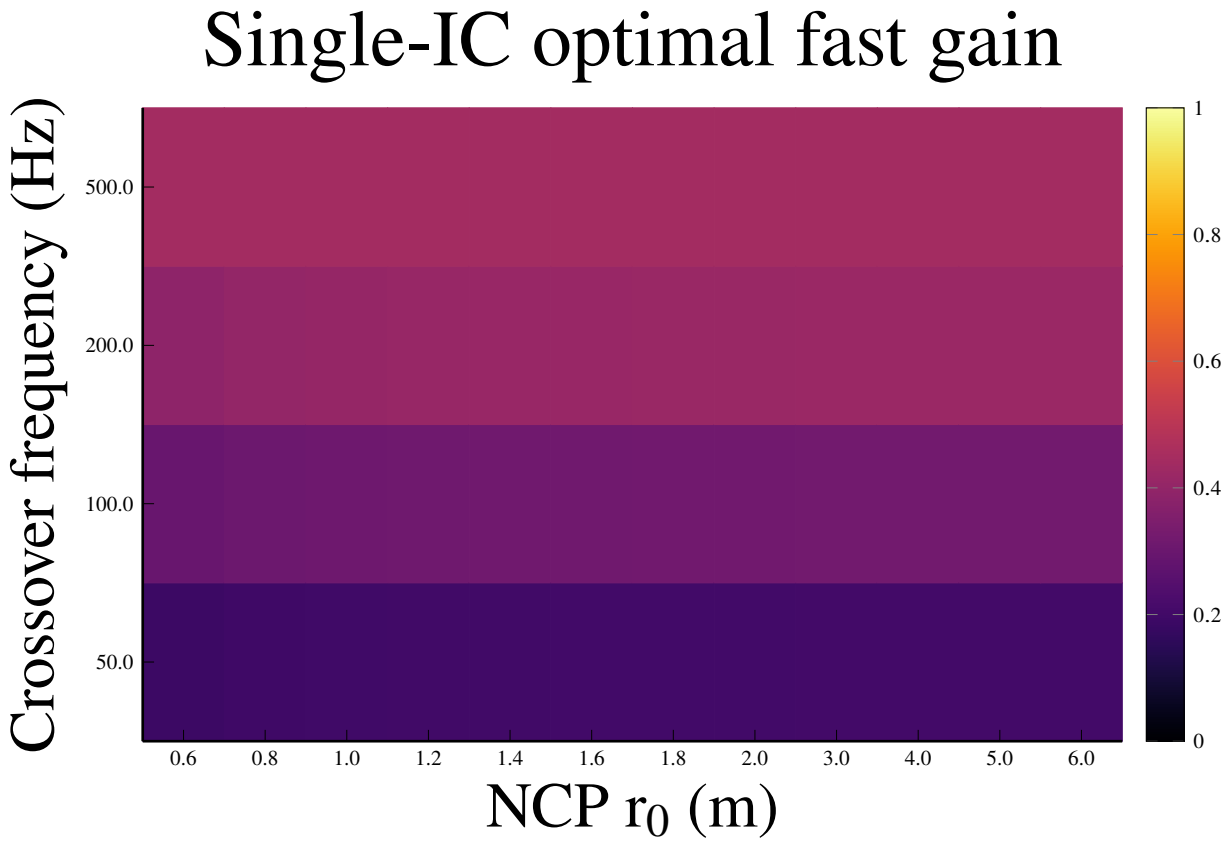

Fast-WFS gain
1.1635
1.1630
1.1625
1.1620
Error at X (rad)
0.90
0.95
1.00
1.05
1.10
Fractional change in parameter


GM = 6.08
PM = 75.02
1.0
0.5
0.0
−0.5
−1.0
−1.0
−0.5
0.0
0.5
1.0

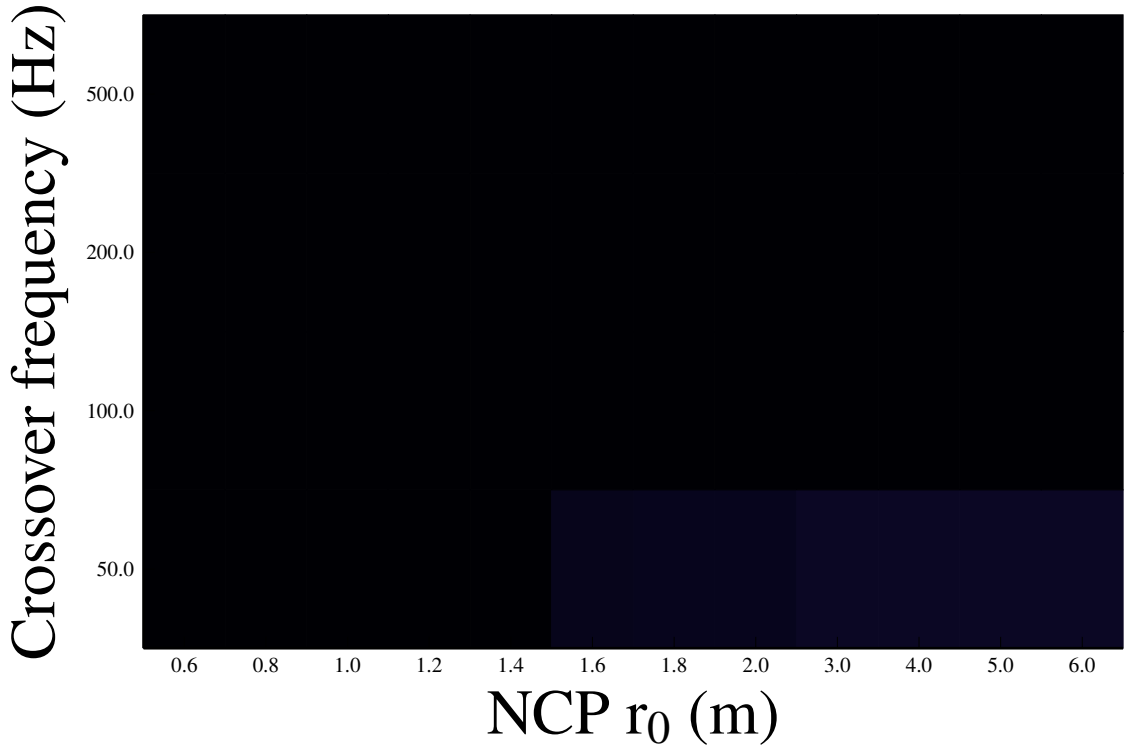

$|X/\phi|^2$
10^0
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
10^{-6}
10^{-3}
10^{-2}
10^{-1}
10^0
10^1
10^2
Frequency (Hz)
Optimized IC
Optimized LQG-IC
LQG-IC plus filter

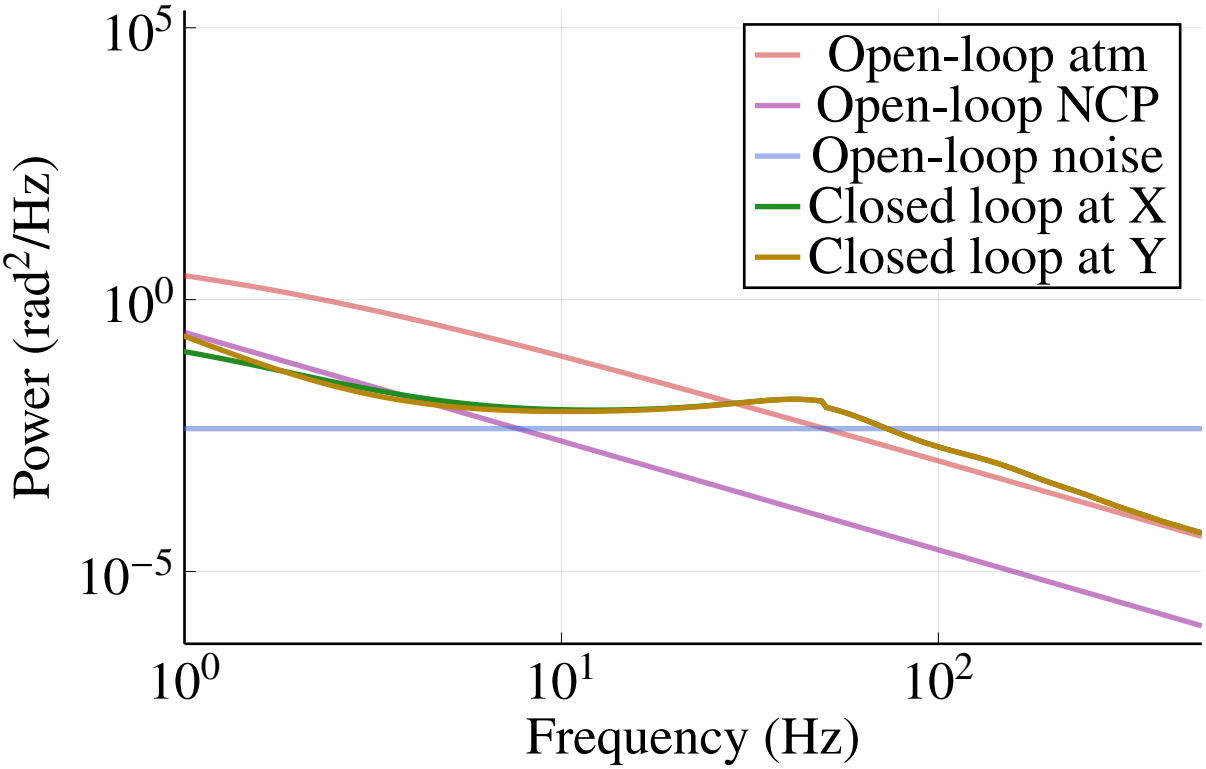

Open-loop atm
Open-loop NCP
Open-loop noise
Closed loop at X
Closed loop at Y
Power (rad²/Hz)
10⁵
10⁰
10⁻⁵
10⁰
10¹
10²
Frequency (Hz)

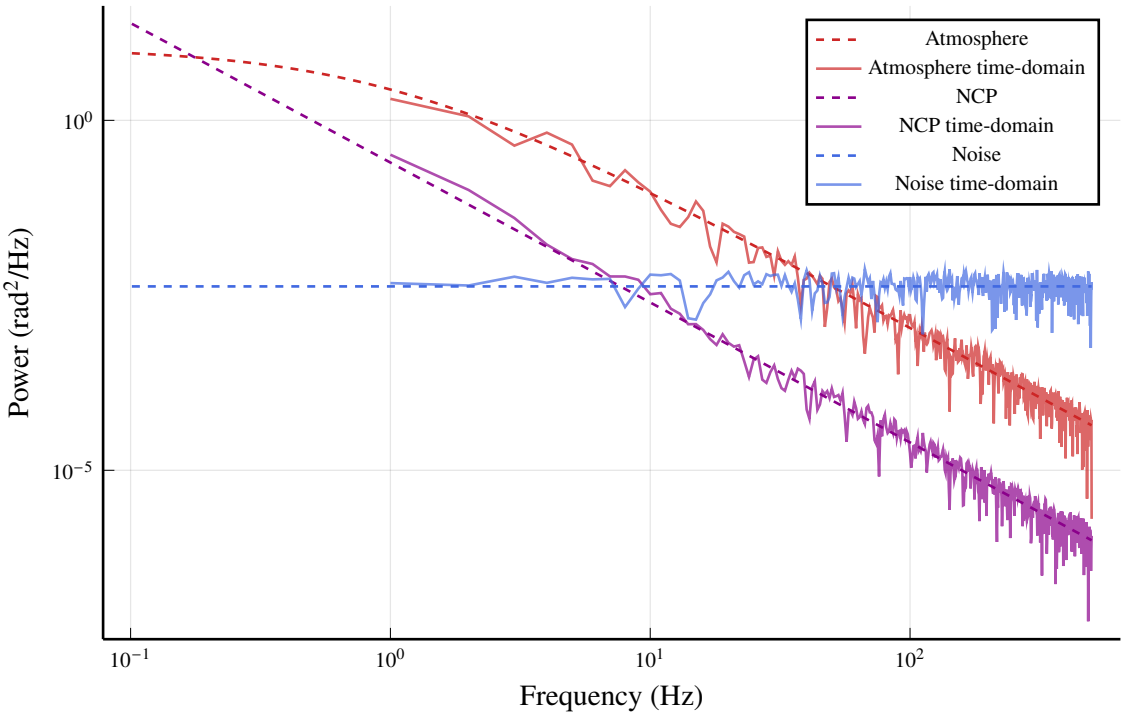

Atmosphere at X
NCP at X
NCP at Y
Noise at X
cost cutoff freq.
Closed-loop residual (rad²/Hz)
10³
10¹
10⁻¹
10⁻³
10⁻⁵
10⁰
10¹
10²
Frequency (Hz)

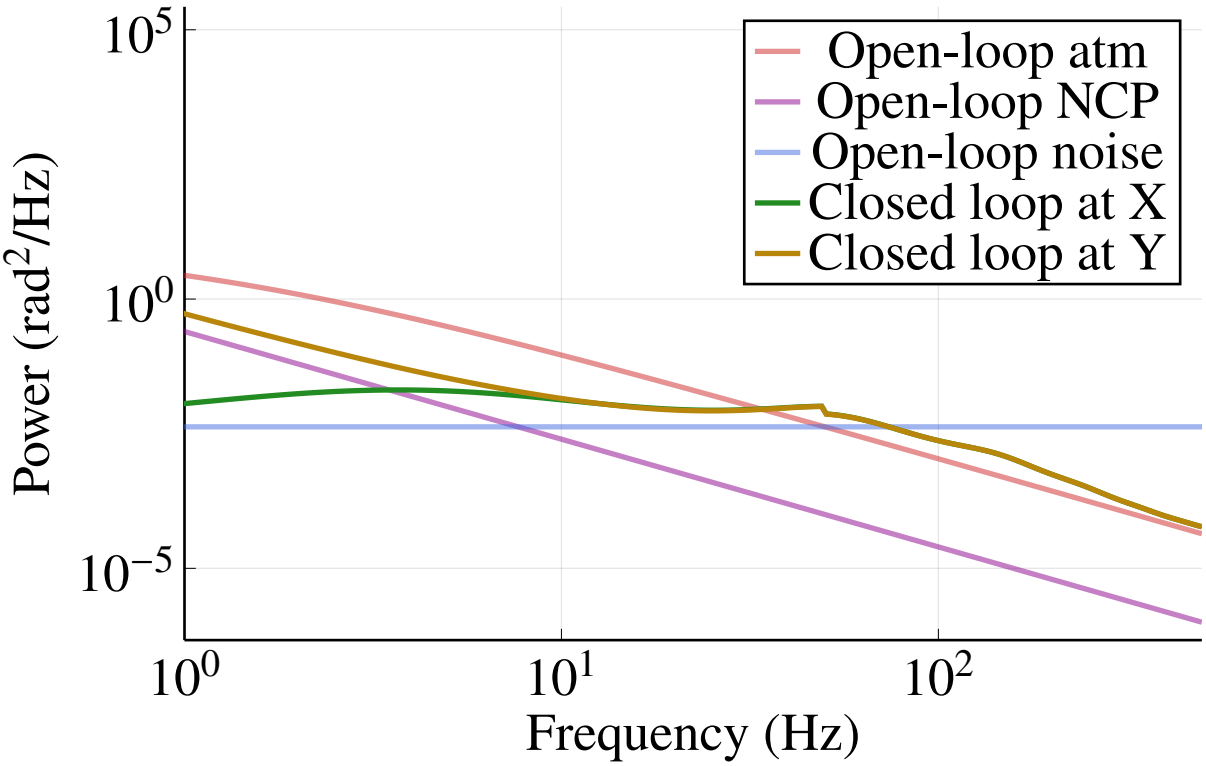

Single-IC optimal fast gain
Crossover frequency (Hz)
500.0
200.0
100.0
50.0
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
3.0
4.0
5.0
6.0
NCP r0 (m)
1
0.8
0.6
0.4
0.2
0

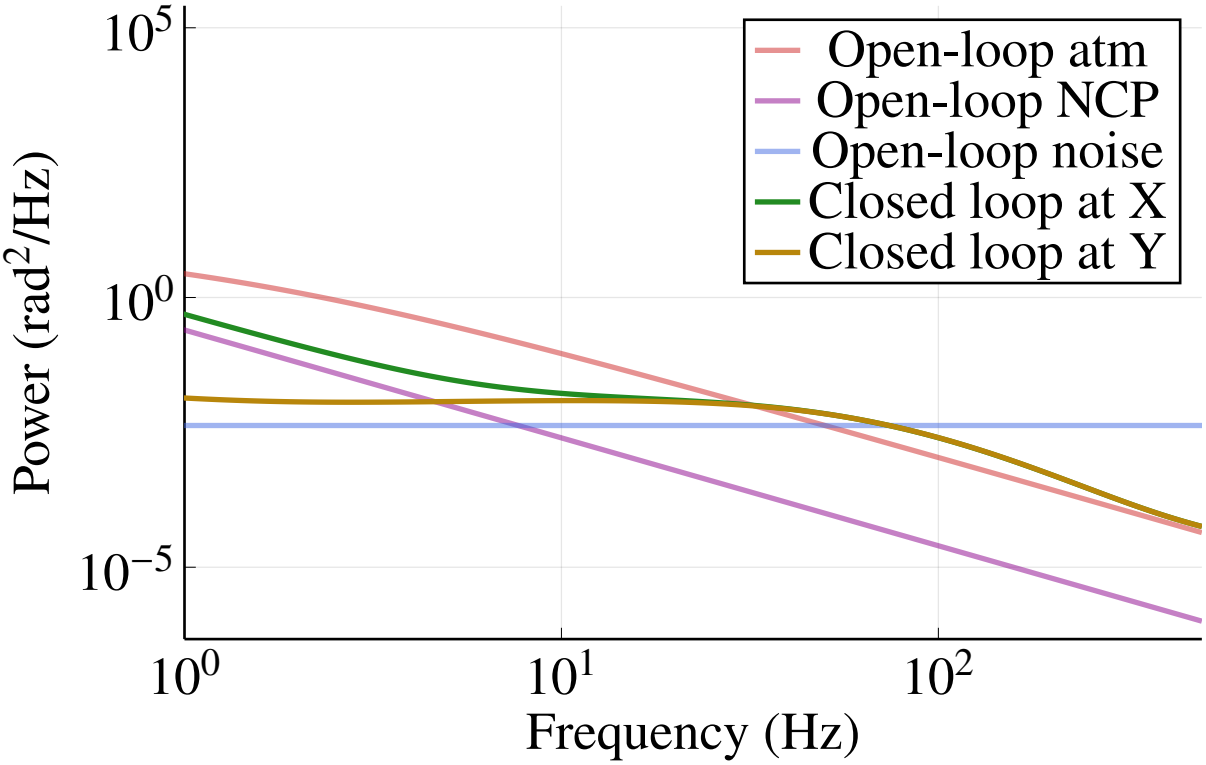
LQG-IC-HPF optimal slow $\log_{10}$(noise)

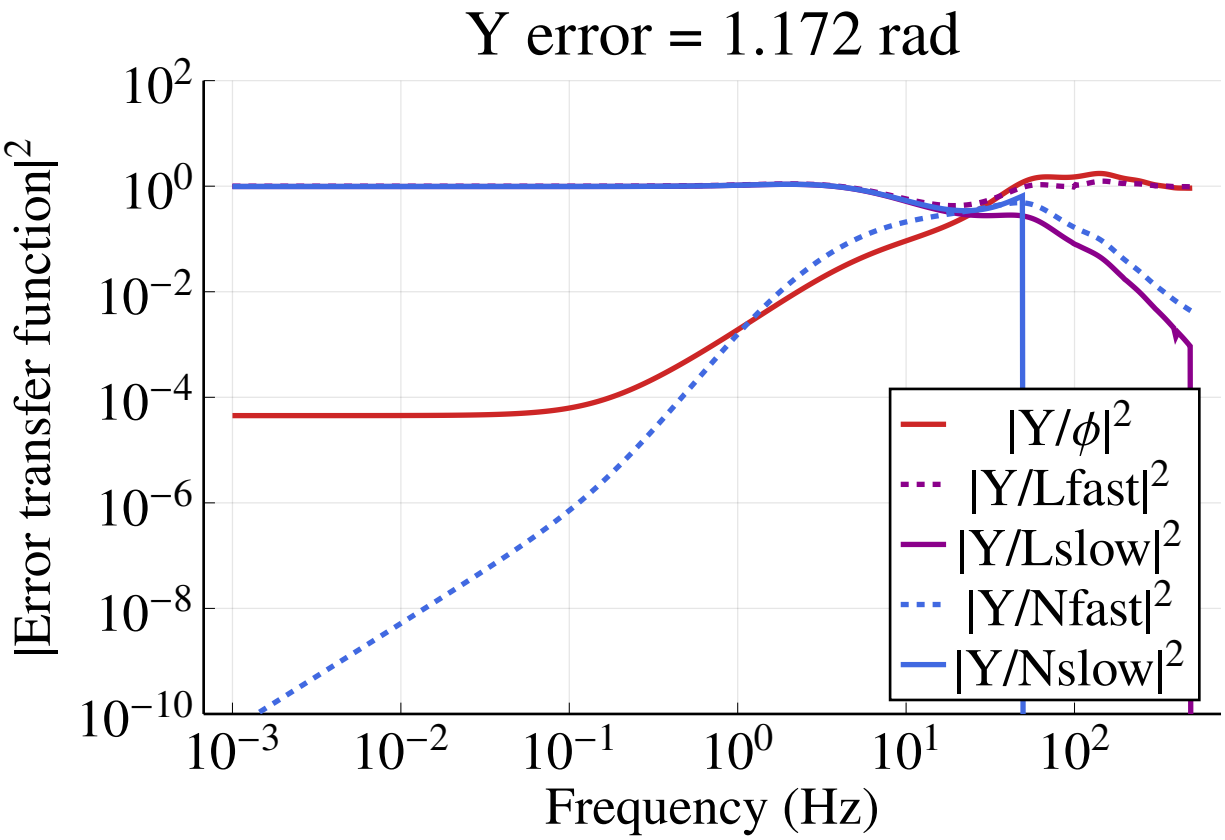


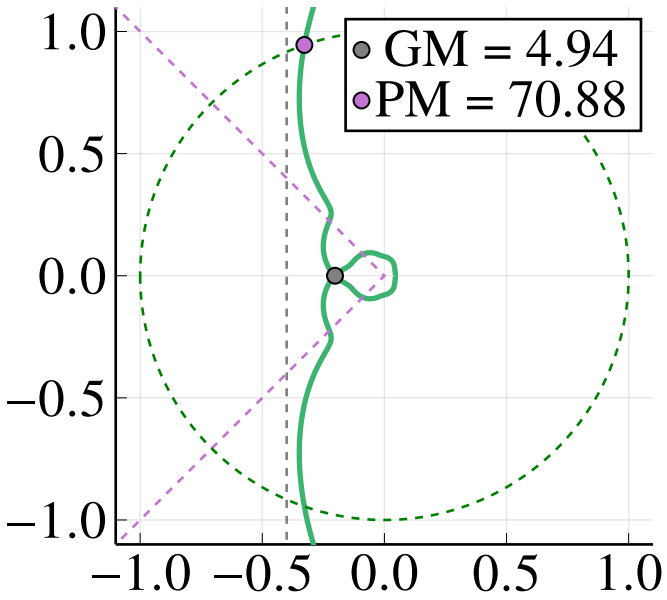

Open-loop atm
Open-loop NCP
Open-loop noise
Closed loop at X
Closed loop at Y
Power (rad²/Hz)
10⁵
10⁰
10⁻⁵
10⁰
10¹
10²
Frequency (Hz)

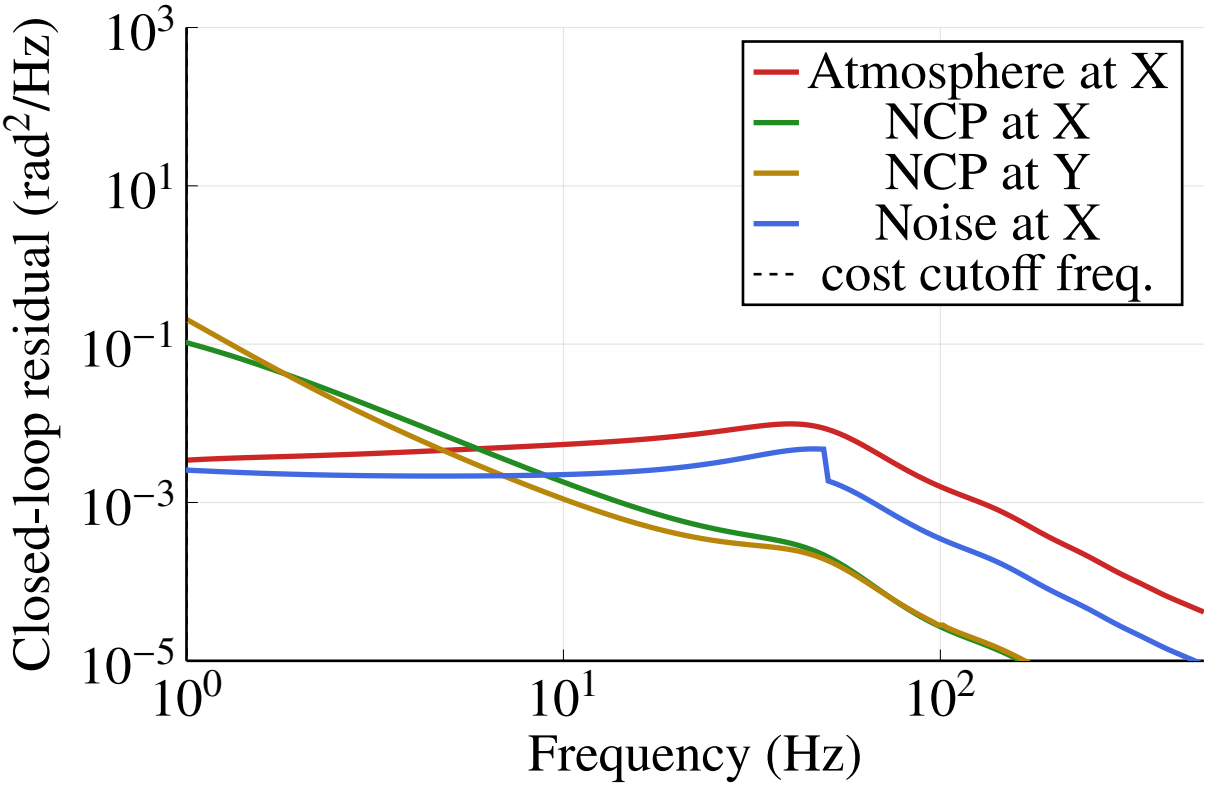

Atmosphere
Atmosphere time-domain
NCP
NCP time-domain
Noise
Noise time-domain
10^0
10^{-5}
Power (rad^2/Hz)
10^{-1}
10^0
10^1
10^2
Frequency (Hz)

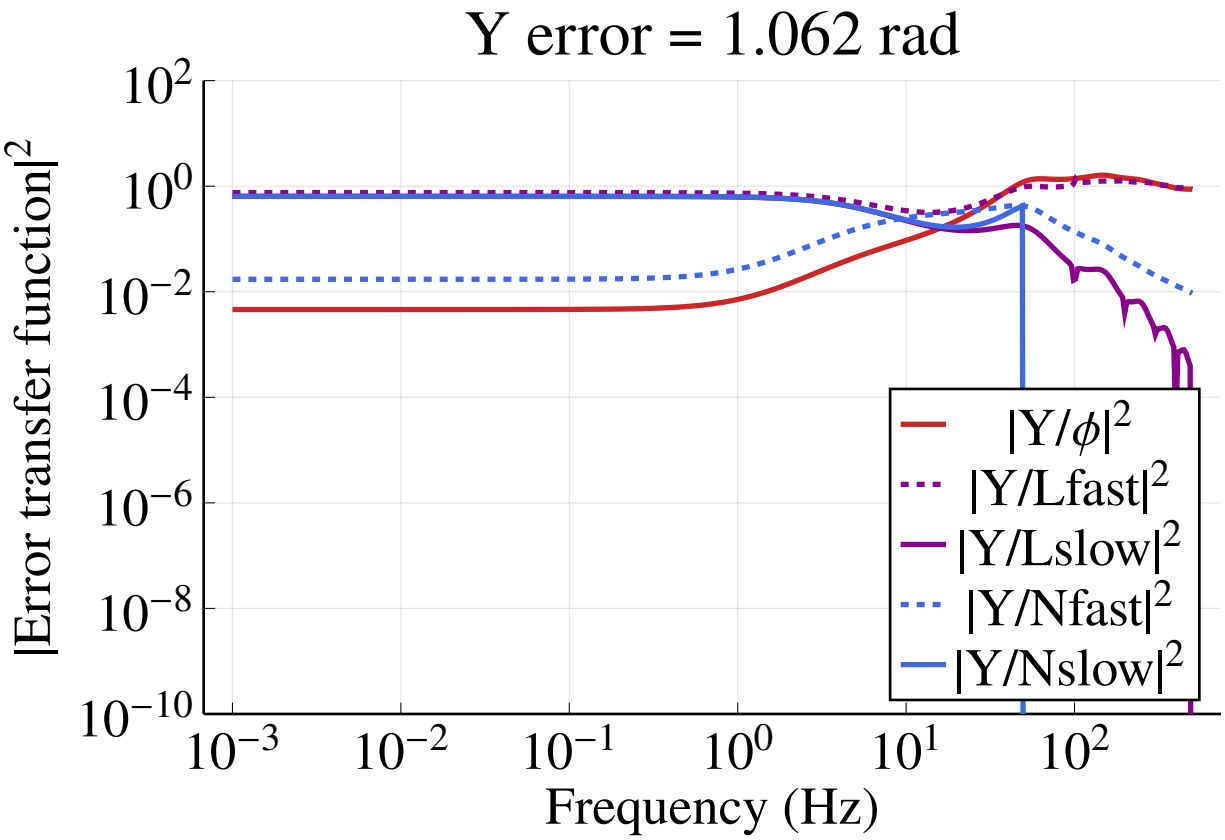

Open-loop atm
Open-loop NCP
Open-loop noise
Closed loop at X
Closed loop at Y
10^5
10^0
10^{-5}
Power (rad^2/Hz)
10^0
10^1
10^2
Frequency (Hz)

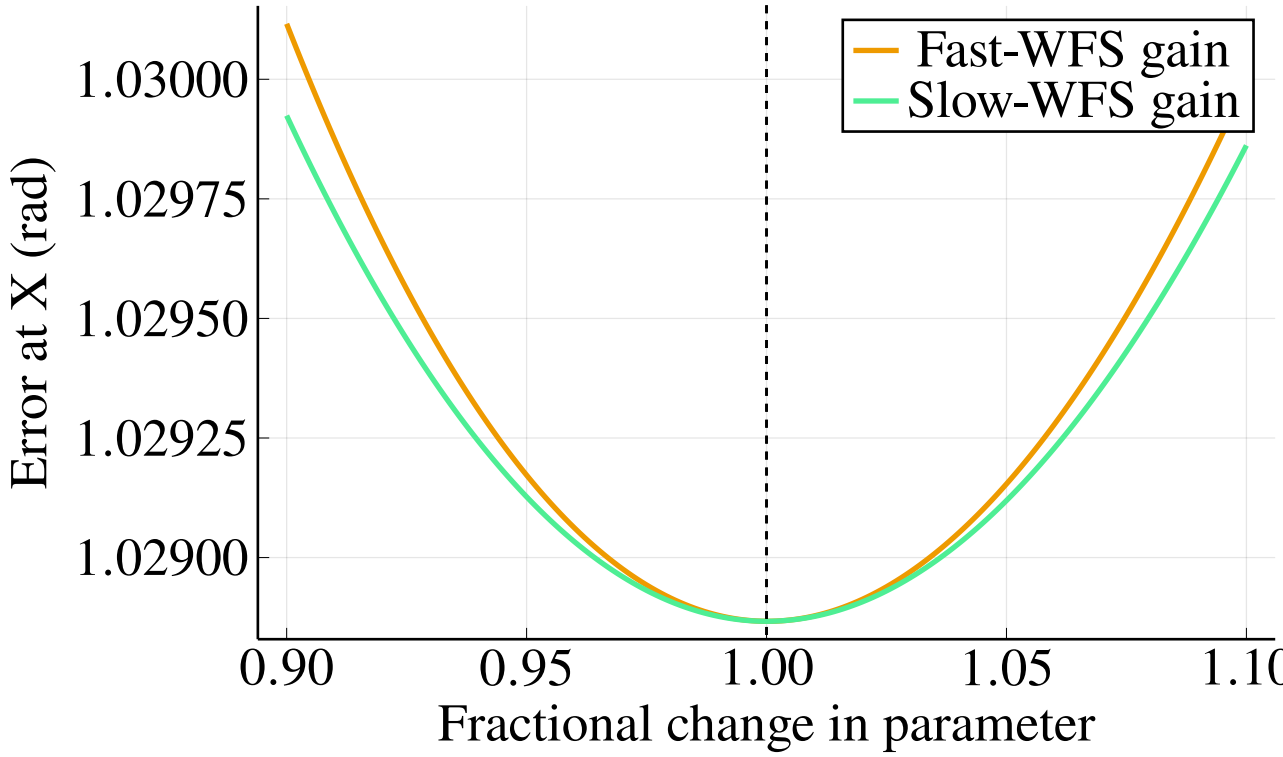

Open-loop atm
Open-loop NCP
Open-loop noise
Closed loop at X
Closed loop at Y
Power (rad²/Hz)
10⁵
10⁰
10⁻⁵
10⁰
10¹
10²
Frequency (Hz)


Y error = 1.172 rad
|Error transfer function|^2
10^{2}
10^{0}
10^{-2}
10^{-4}
10^{-6}
10^{-8}
10^{-10}
10^{-3}
10^{-2}
10^{-1}
10^{0}
10^{1}
10^{2}
Frequency (Hz)
|Y/ϕ|^2
|Y/Lfast|^2
|Y/Lslow|^2
|Y/Nfast|^2
|Y/Nslow|^2

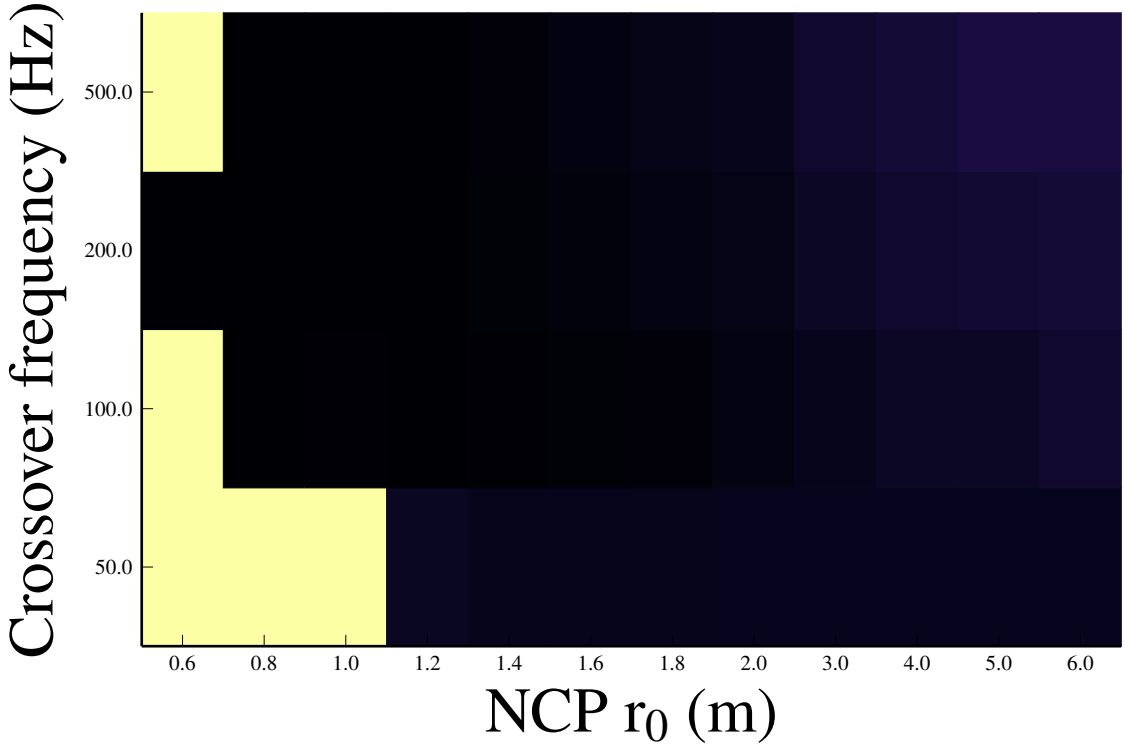

GM = 4.94
PM = 70.88
1.0
0.5
0.0
−0.5
−1.0
−1.0
−0.5
0.0
0.5
1.0

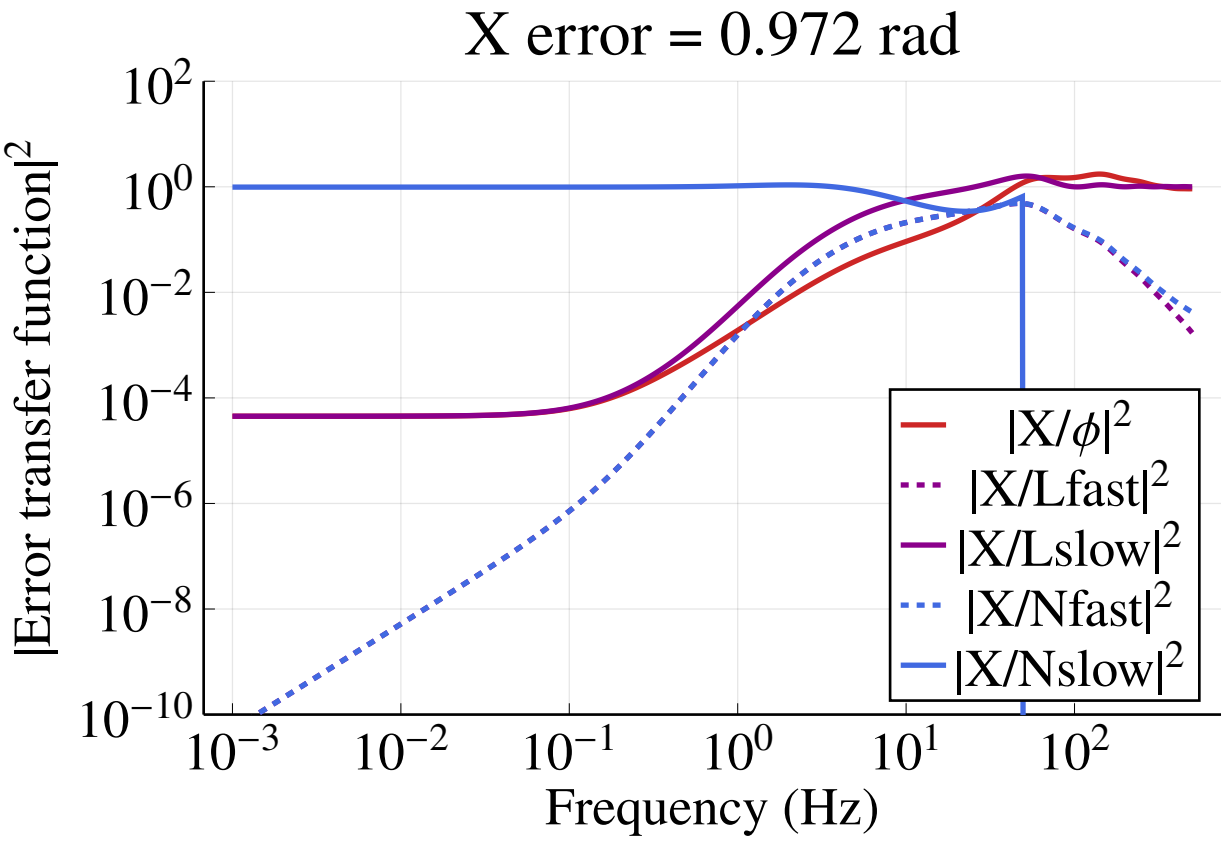

Closed-loop residual (rad²/Hz)
10³
10¹
10⁻¹
10⁻³
10⁻⁵
10⁰
10¹
10²
Frequency (Hz)
Atmosphere at X
NCP at X
NCP at Y
Noise at X
cost cutoff freq.


Y error = 1.062 rad
|Error transfer function|^2
10^{2}
10^{0}
10^{-2}
10^{-4}
10^{-6}
10^{-8}
10^{-10}
10^{-3}
10^{-2}
10^{-1}
10^{0}
10^{1}
10^{2}
Frequency (Hz)
|Y/ϕ|^2
|Y/Lfast|^2
|Y/Lslow|^2
|Y/Nfast|^2
|Y/Nslow|^2

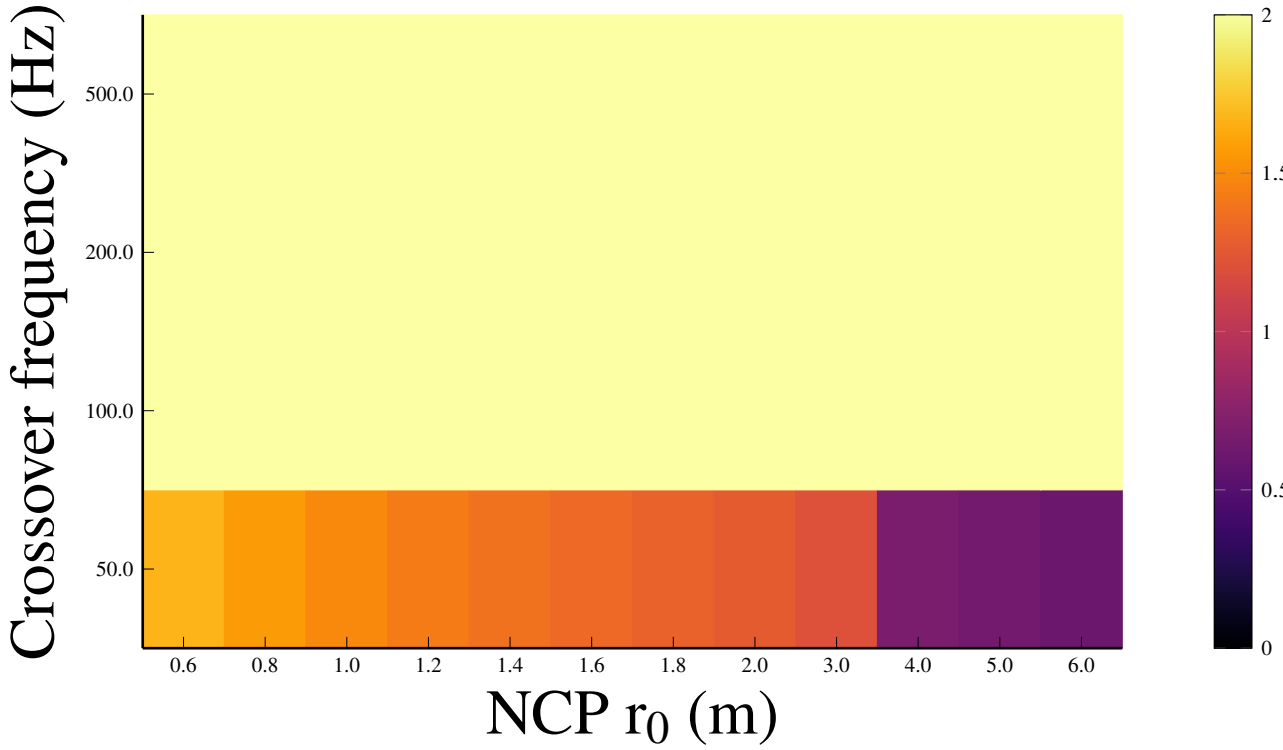

Fast-WFS gain
Slow-WFS gain
Error at X (rad)
1.03000
1.02975
1.02950
1.02925
1.02900
0.90
0.95
1.00
1.05
1.10
Fractional change in parameter

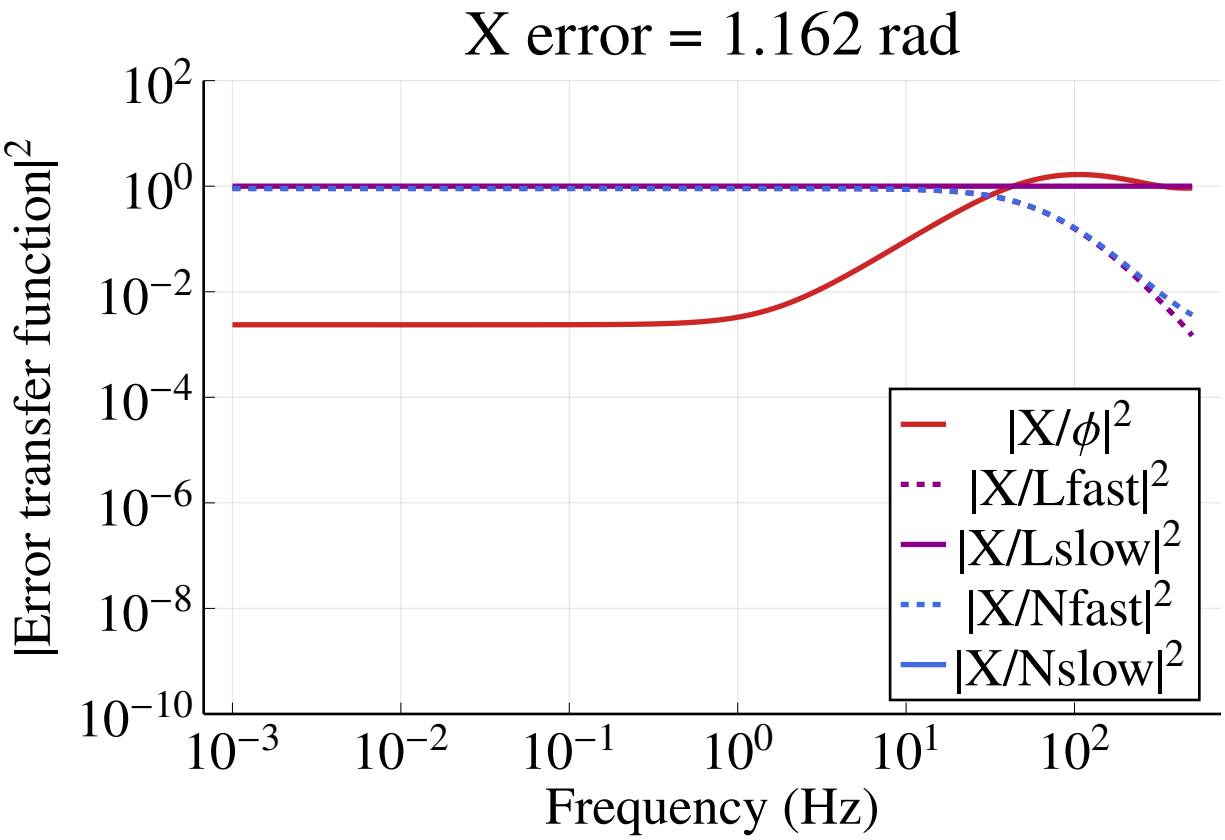
LQG-IC-HPF optimal fast -$\log_{10}(1-\alpha)$

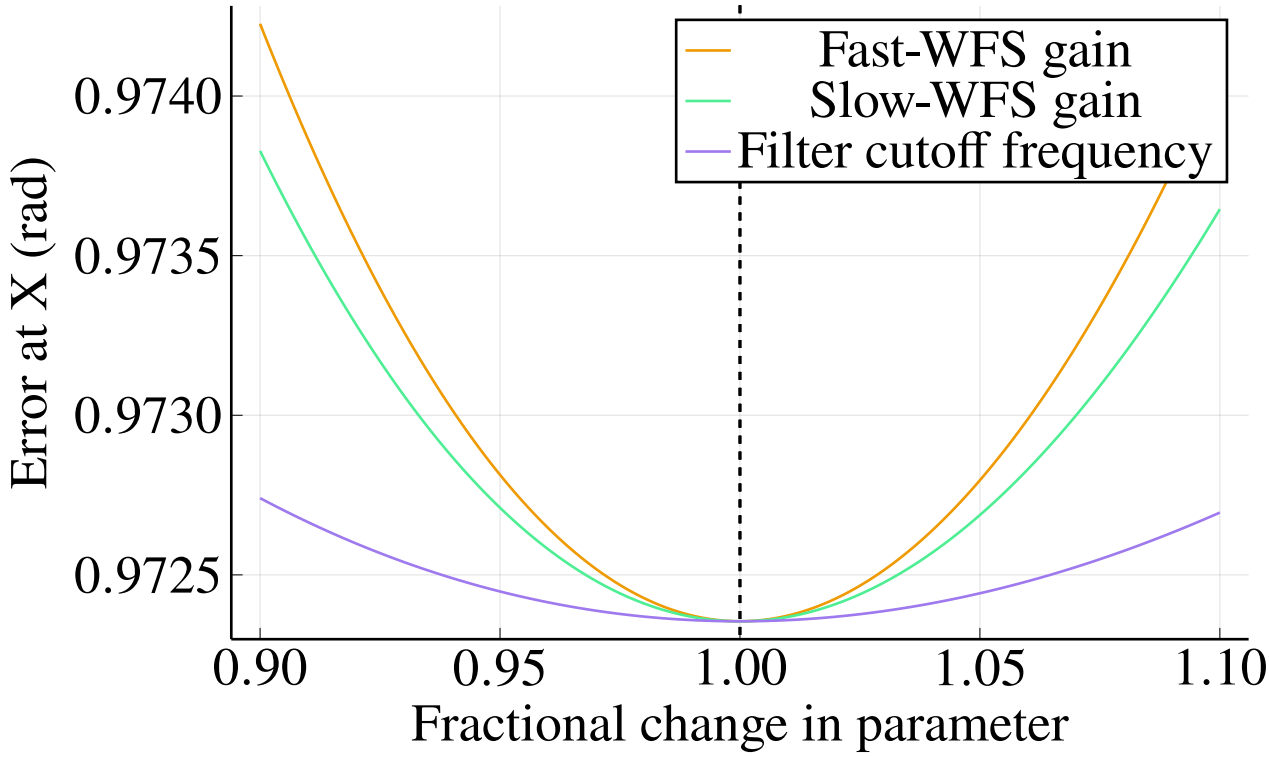



X error = 0.972 rad
|Error transfer function|^2
10^{2}
10^{0}
10^{-2}
10^{-4}
10^{-6}
10^{-8}
10^{-10}
10^{-3}
10^{-2}
10^{-1}
10^{0}
10^{1}
10^{2}
Frequency (Hz)
|X/ϕ|^2
|X/Lfast|^2
|X/Lslow|^2
|X/Nfast|^2
|X/Nslow|^2

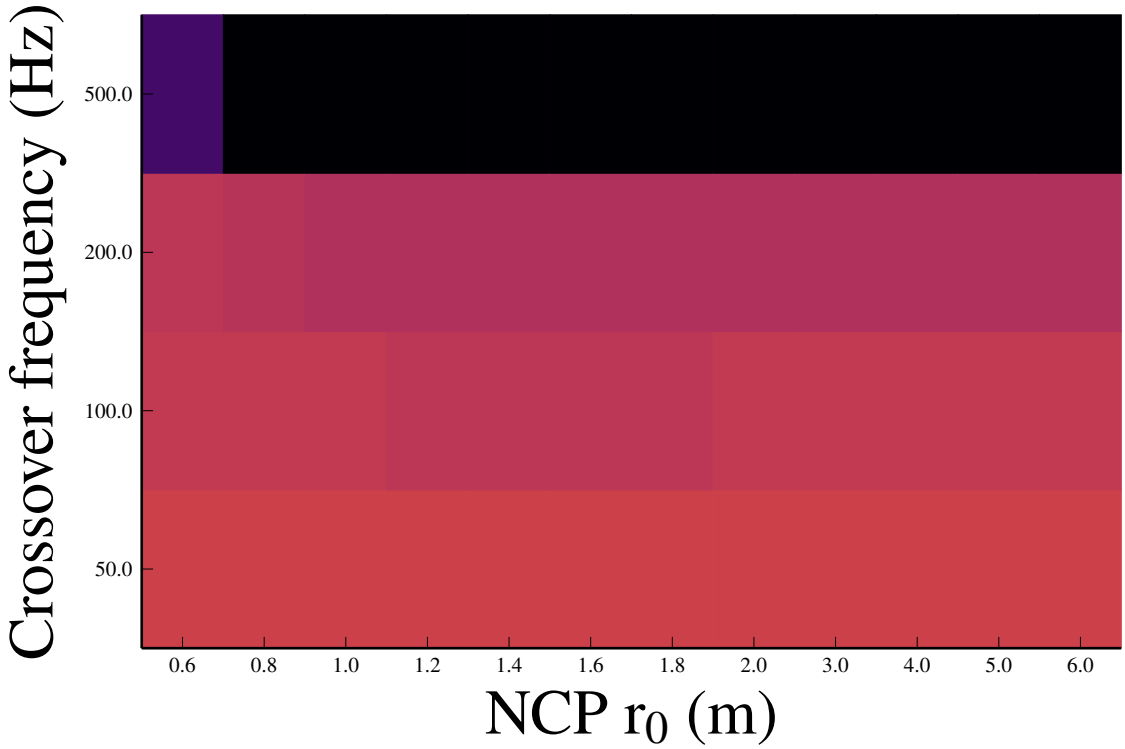
Double-IC-HPF optimal slow gain

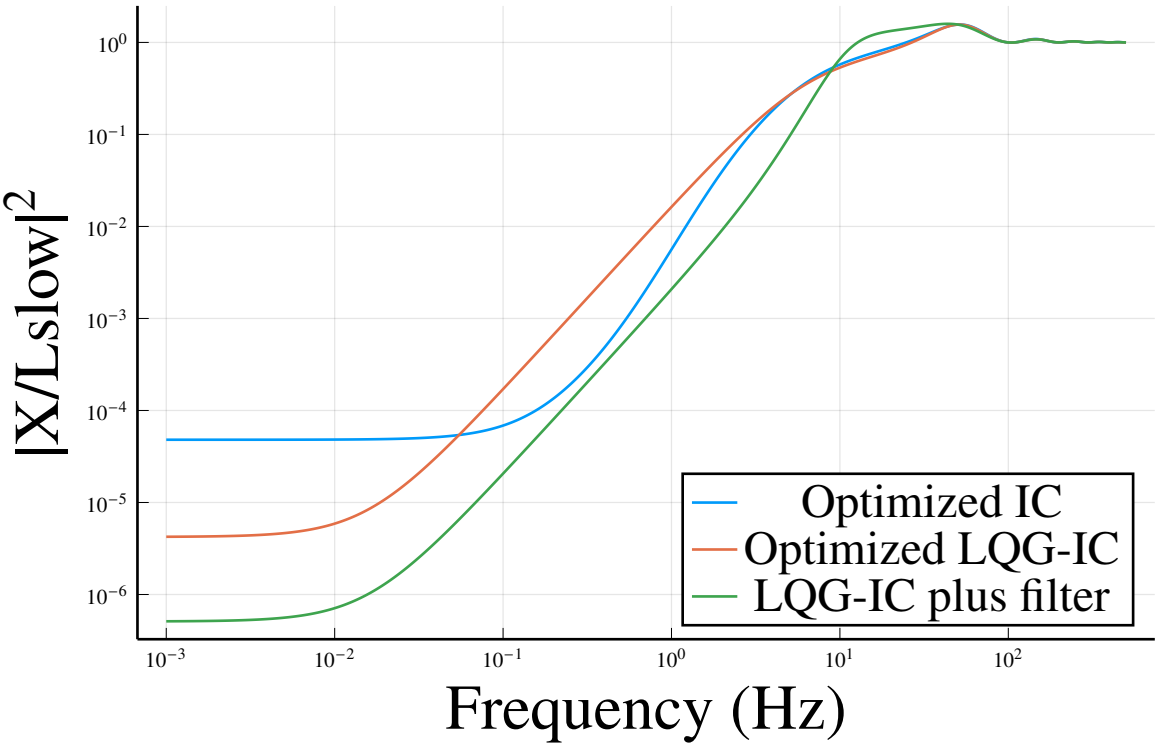


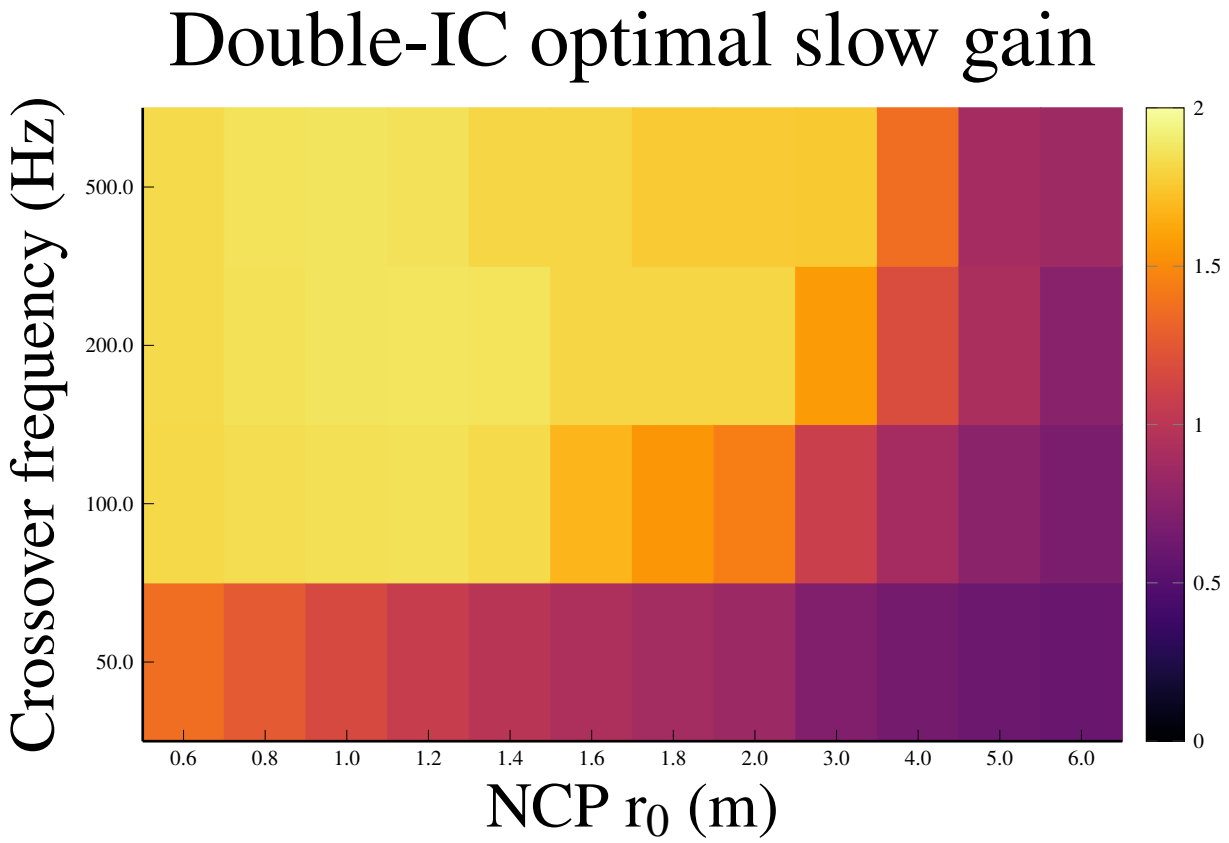

X error = 1.162 rad
|Error transfer function|^2
10^{2}
10^{0}
10^{-2}
10^{-4}
10^{-6}
10^{-8}
10^{-10}
10^{-3}
10^{-2}
10^{-1}
10^{0}
10^{1}
10^{2}
Frequency (Hz)
|X/ϕ|^2
|X/Lfast|^2
|X/Lslow|^2
|X/Nfast|^2
|X/Nslow|^2

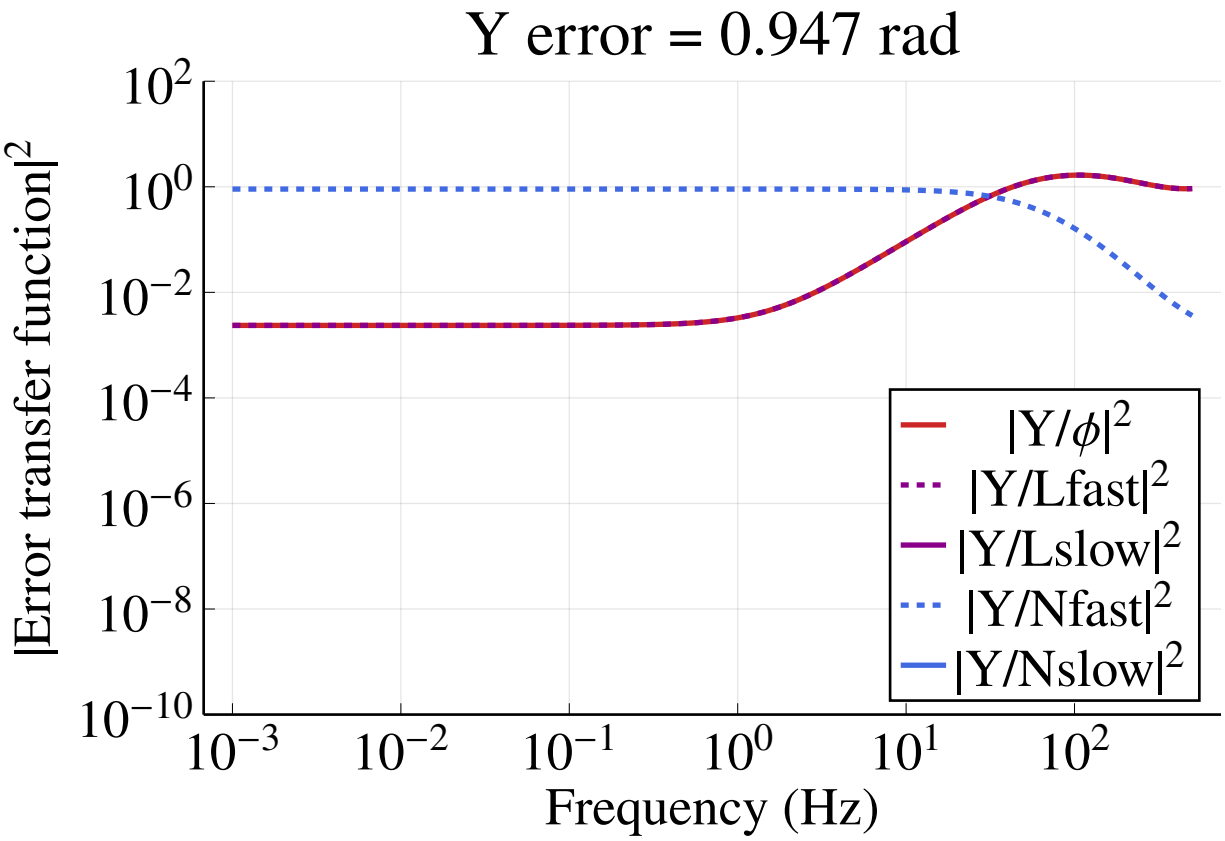

Fast-WFS gain
Slow-WFS gain
Filter cutoff frequency
0.9740
0.9735
0.9730
0.9725
Error at X (rad)
0.90
0.95
1.00
1.05
1.10
Fractional change in parameter

LQG-IC-HPF optimal fast $\log_{10}$(noise)

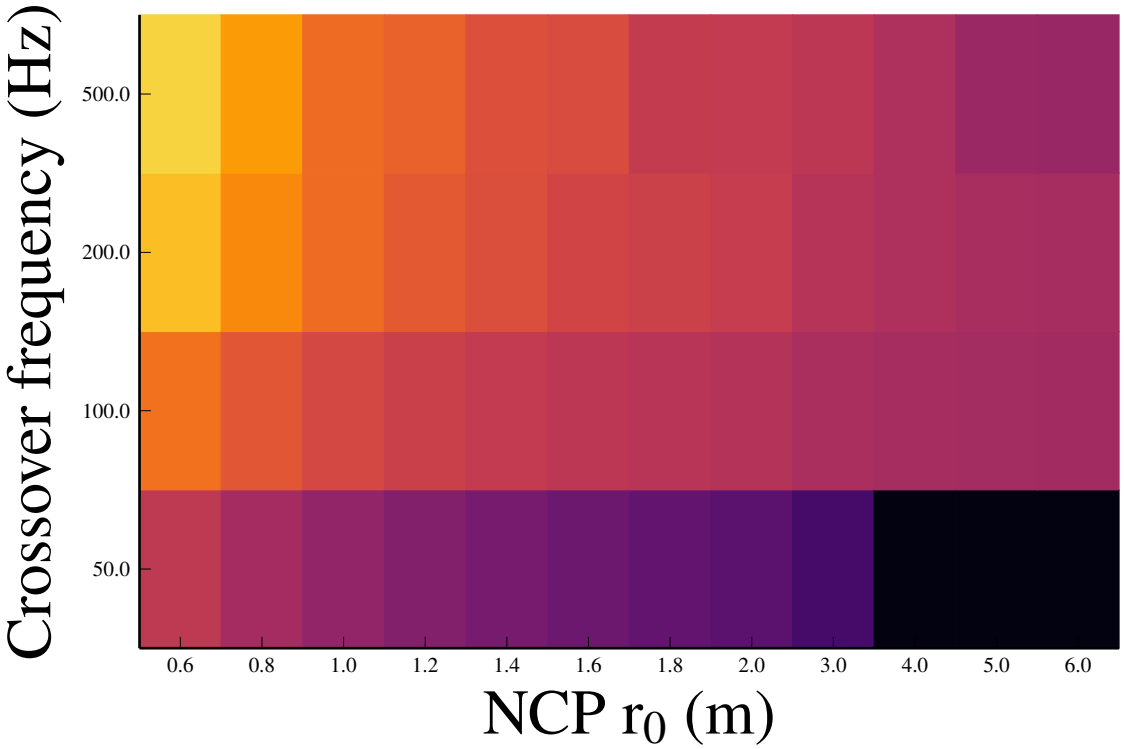


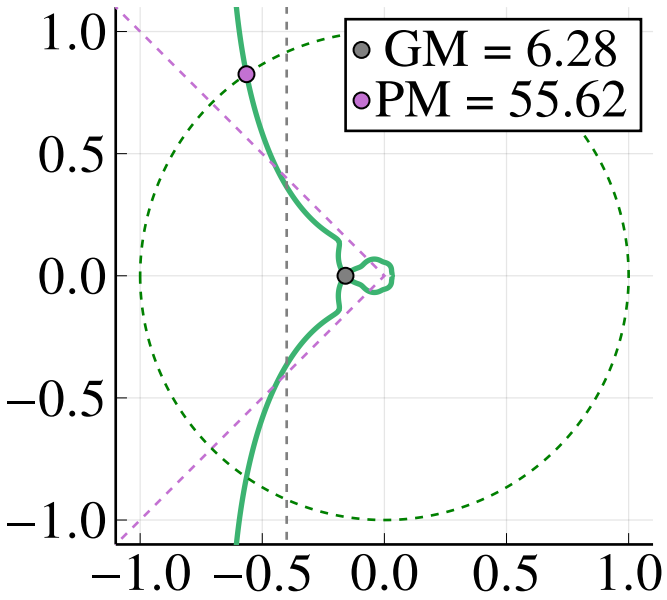

$|X/Lslow|^2$
10^0
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
10^{-6}
10^{-3}
10^{-2}
10^{-1}
10^0
10^1
10^2
Frequency (Hz)
Optimized IC
Optimized LQG-IC
LQG-IC plus filter


Double-IC optimal slow gain
Crossover frequency (Hz)
500.0
200.0
100.0
50.0
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
3.0
4.0
5.0
6.0
NCP r0 (m)
2
1.5
1
0.5
0

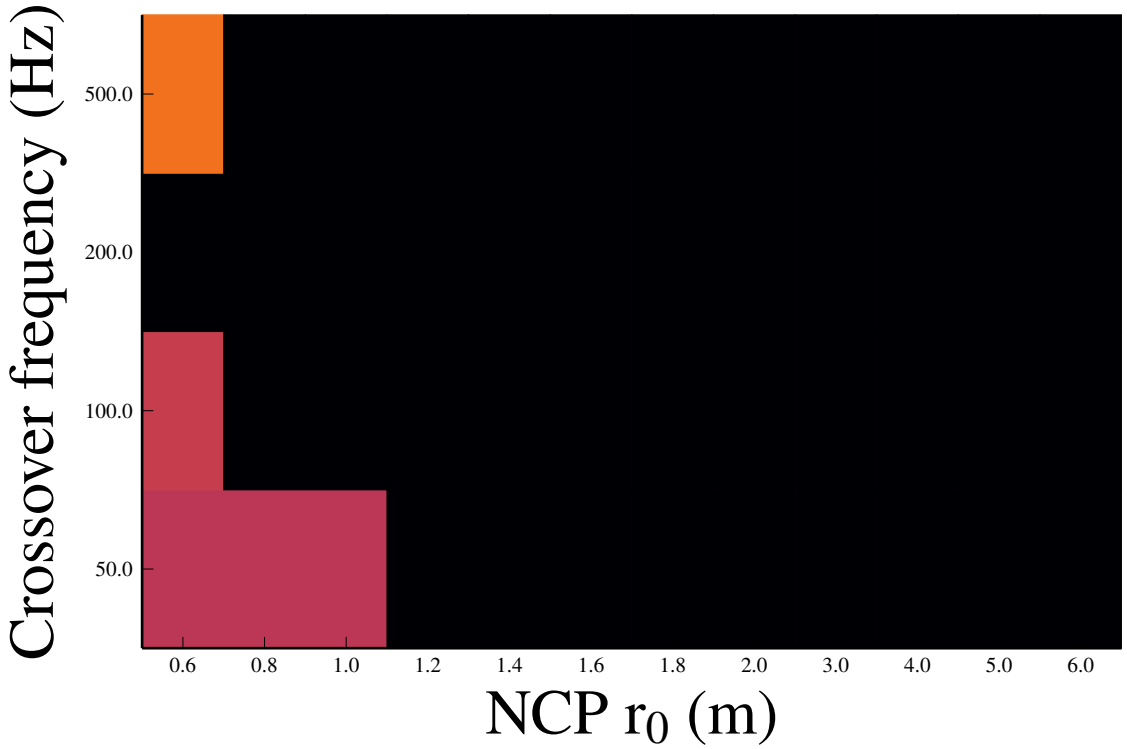

Y error = 0.947 rad
|Error transfer function|^2
10^{2}
10^{0}
10^{-2}
10^{-4}
10^{-6}
10^{-8}
10^{-10}
10^{-3}
10^{-2}
10^{-1}
10^{0}
10^{1}
10^{2}
Frequency (Hz)
|Y/ϕ|^2
|Y/Lfast|^2
|Y/Lslow|^2
|Y/Nfast|^2
|Y/Nslow|^2

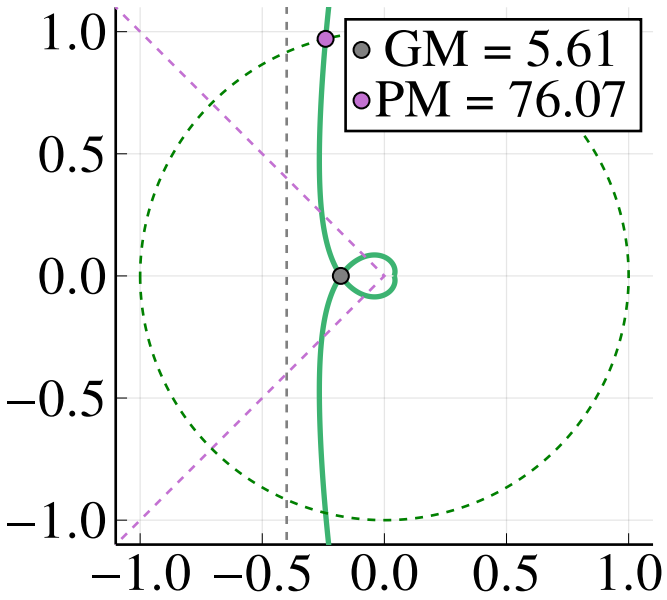
Double-IC-HPF optimal cutoff frequenc

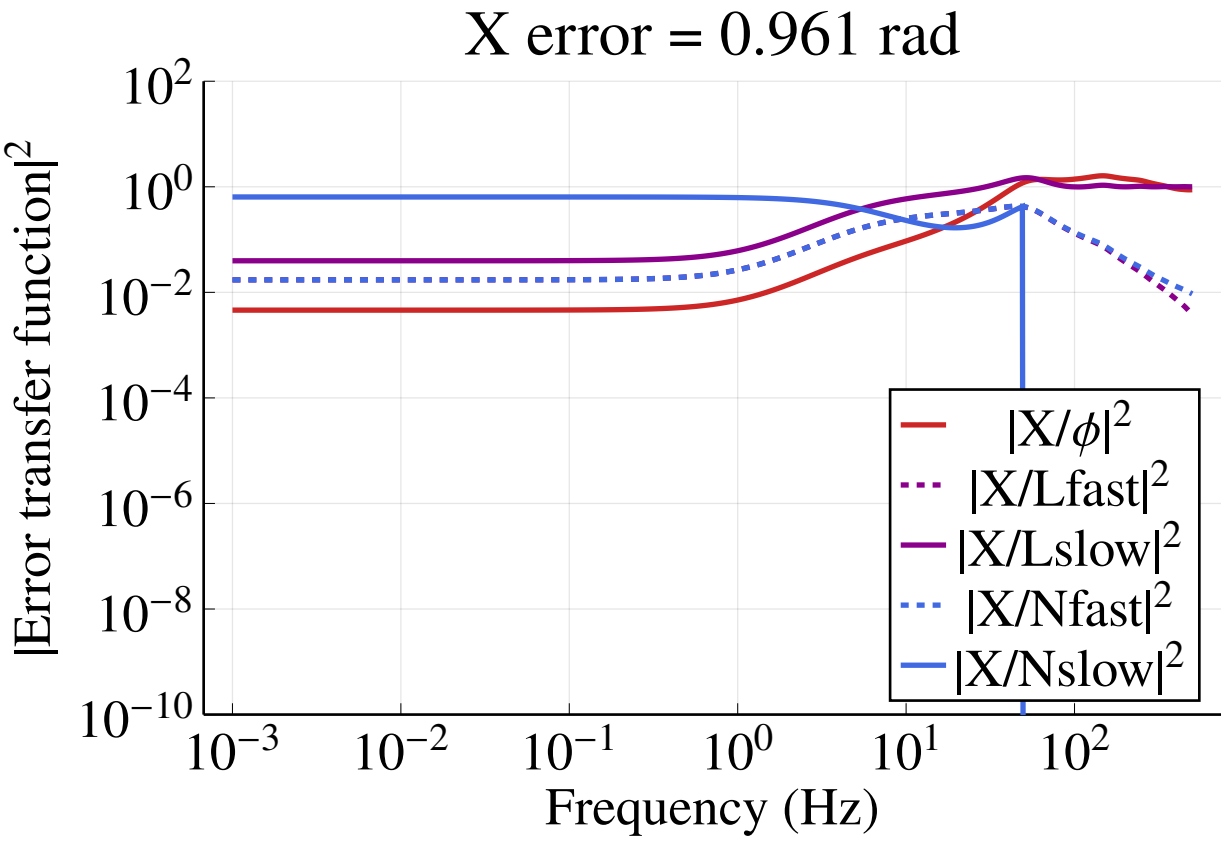


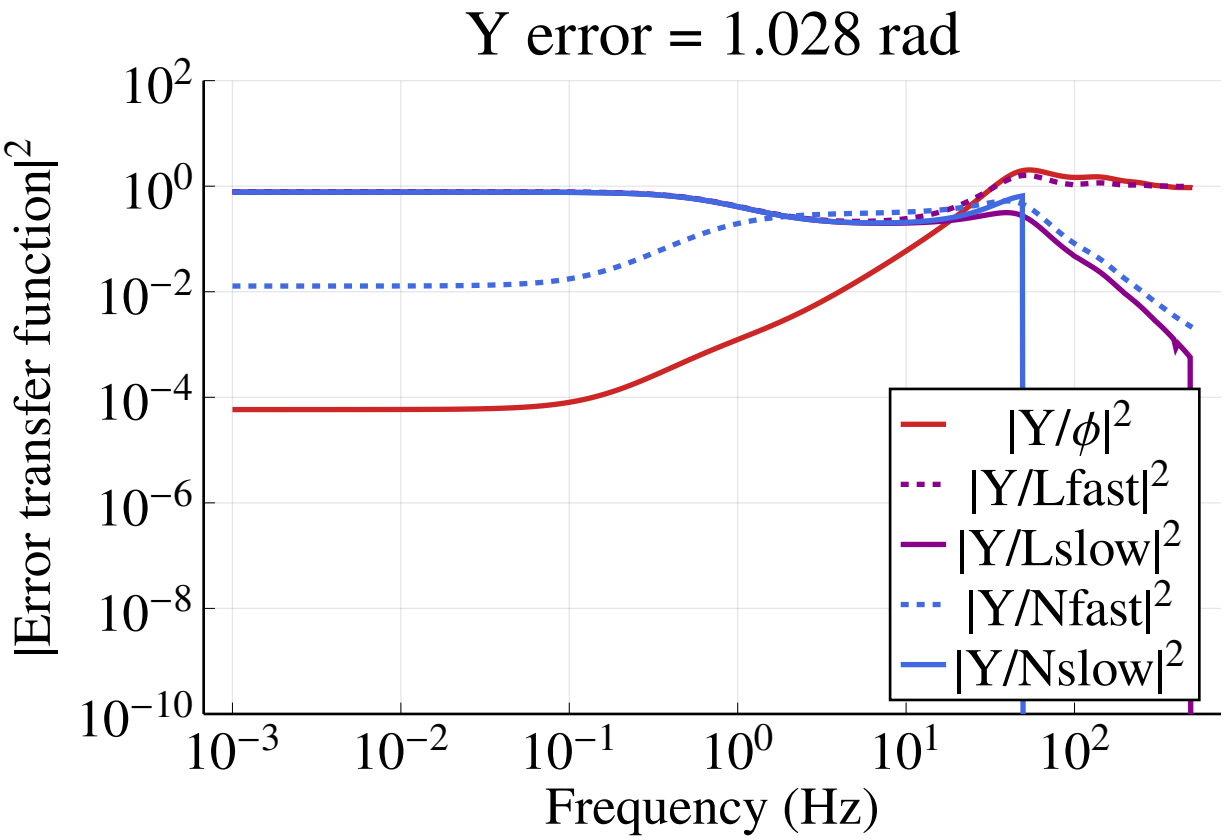

GM = 6.28
PM = 55.62
1.0
0.5
0.0
−0.5
−1.0
−1.0
−0.5
0.0
0.5
1.0

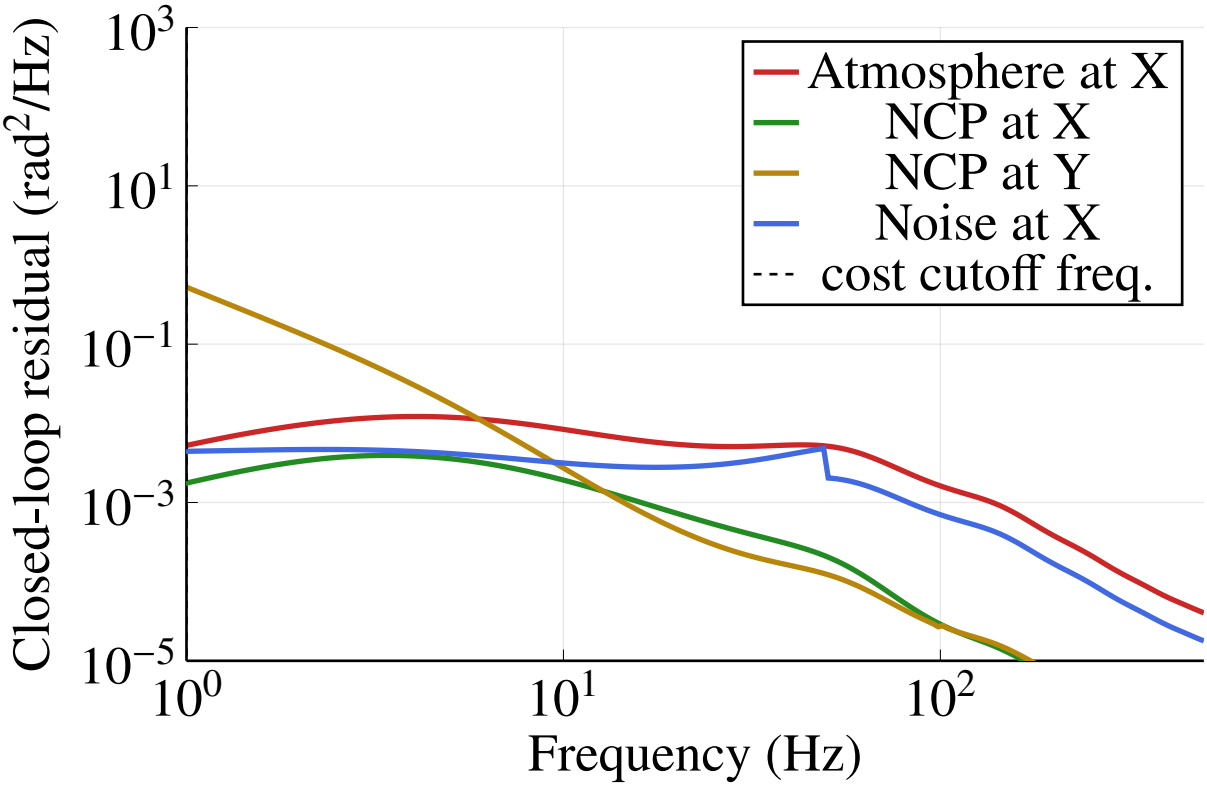
LQG-IC-HPF optimal cutoff frequency

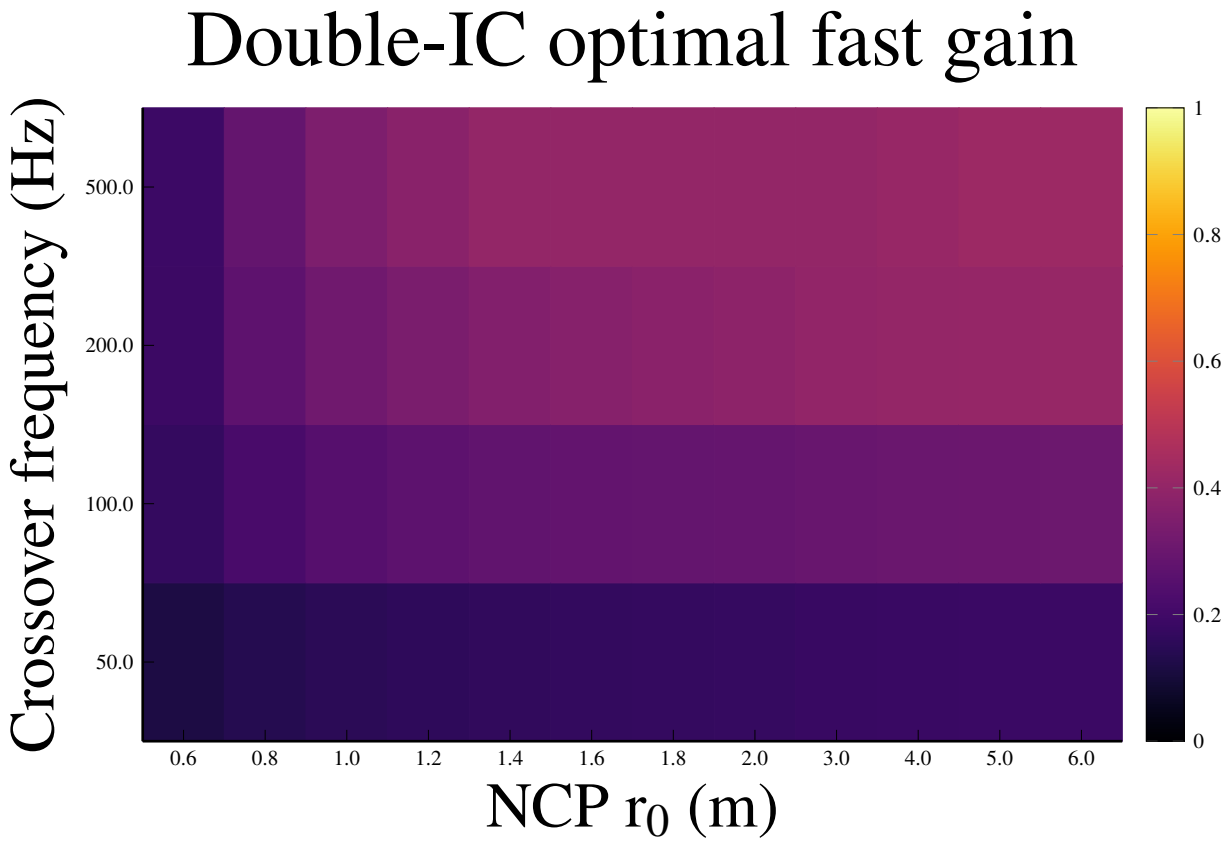



GM = 5.61
PM = 76.07
1.0
0.5
0.0
−0.5
−1.0
−1.0
−0.5
0.0
0.5
1.0


X error = 0.961 rad
|Error transfer function|^2
10^{2}
10^{0}
10^{-2}
10^{-4}
10^{-6}
10^{-8}
10^{-10}
10^{-3}
10^{-2}
10^{-1}
10^{0}
10^{1}
10^{2}
Frequency (Hz)
|X/ϕ|^2
|X/Lfast|^2
|X/Lslow|^2
|X/Nfast|^2
|X/Nslow|^2


Y error = 1.028 rad
|Error transfer function|^2
10^{2}
10^{0}
10^{-2}
10^{-4}
10^{-6}
10^{-8}
10^{-10}
10^{-3}
10^{-2}
10^{-1}
10^{0}
10^{1}
10^{2}
Frequency (Hz)
|Y/ϕ|^2
|Y/Lfast|^2
|Y/Lslow|^2
|Y/Nfast|^2
|Y/Nslow|^2


Closed-loop residual (rad²/Hz)
10³
10¹
10⁻¹
10⁻³
10⁻⁵
10⁰
10¹
10²
Frequency (Hz)
Atmosphere at X
NCP at X
NCP at Y
Noise at X
cost cutoff freq.


Double-IC optimal fast gain
Crossover frequency (Hz)
500.0
200.0
100.0
50.0
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
3.0
4.0
5.0
6.0
NCP r0 (m)
1
0.8
0.6
0.4
0.2
0

LQG-IC-HPF optimal slow $-\log_{10}(1-\alpha)$