

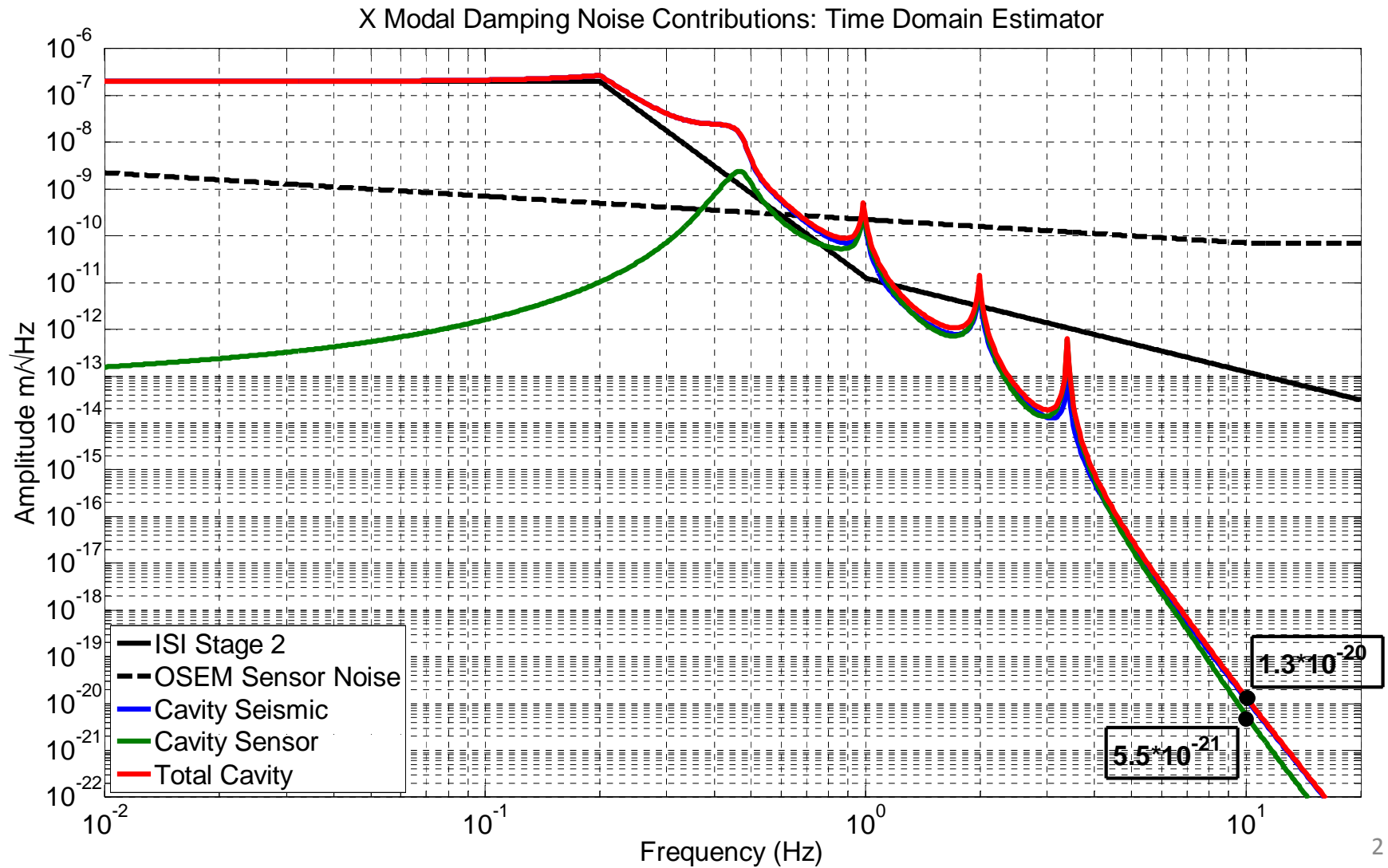
# Modal Damping Notes

Brett Shapiro

8 June 2011

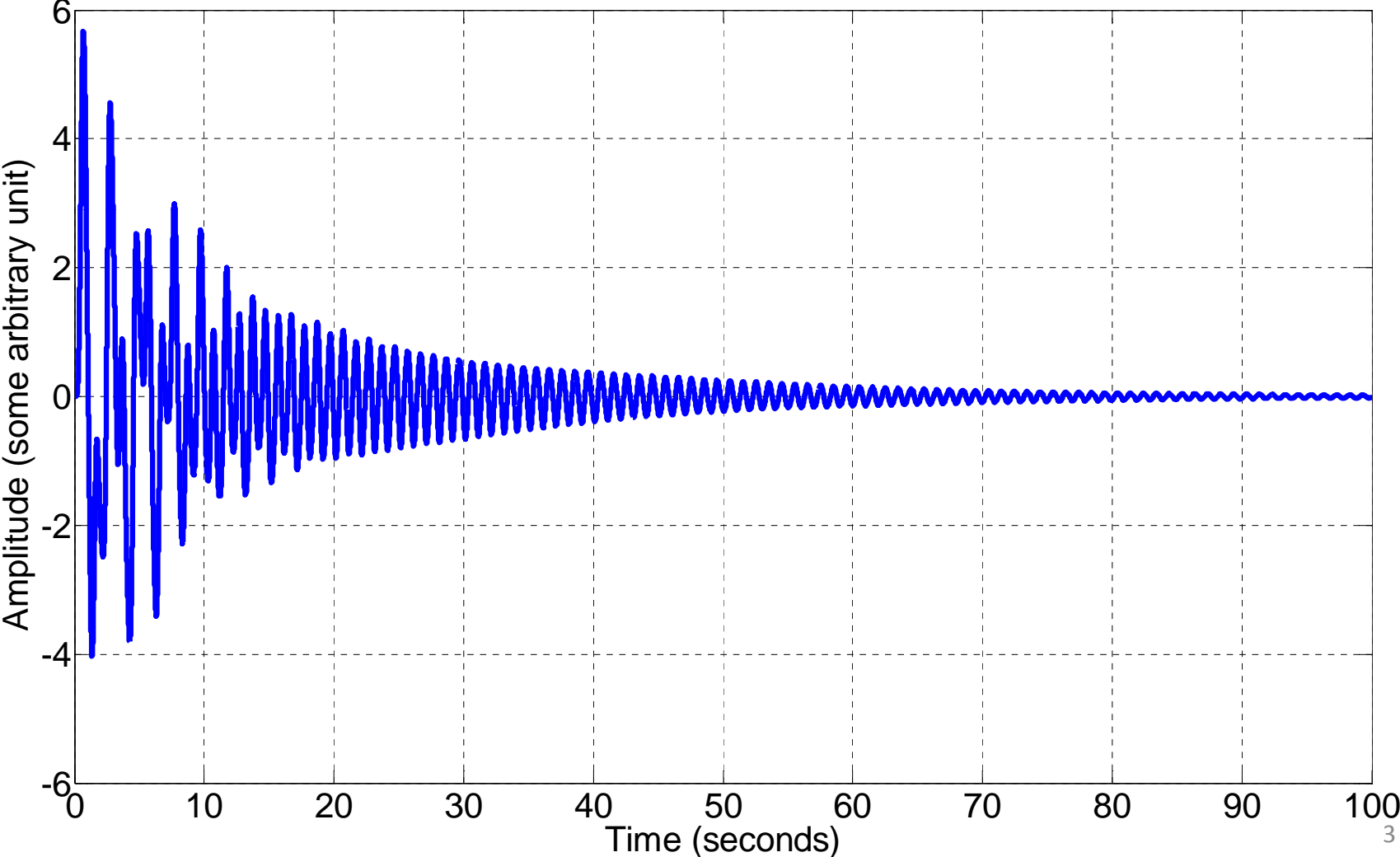
G1100755

# Low Gain Modal Damping Noise

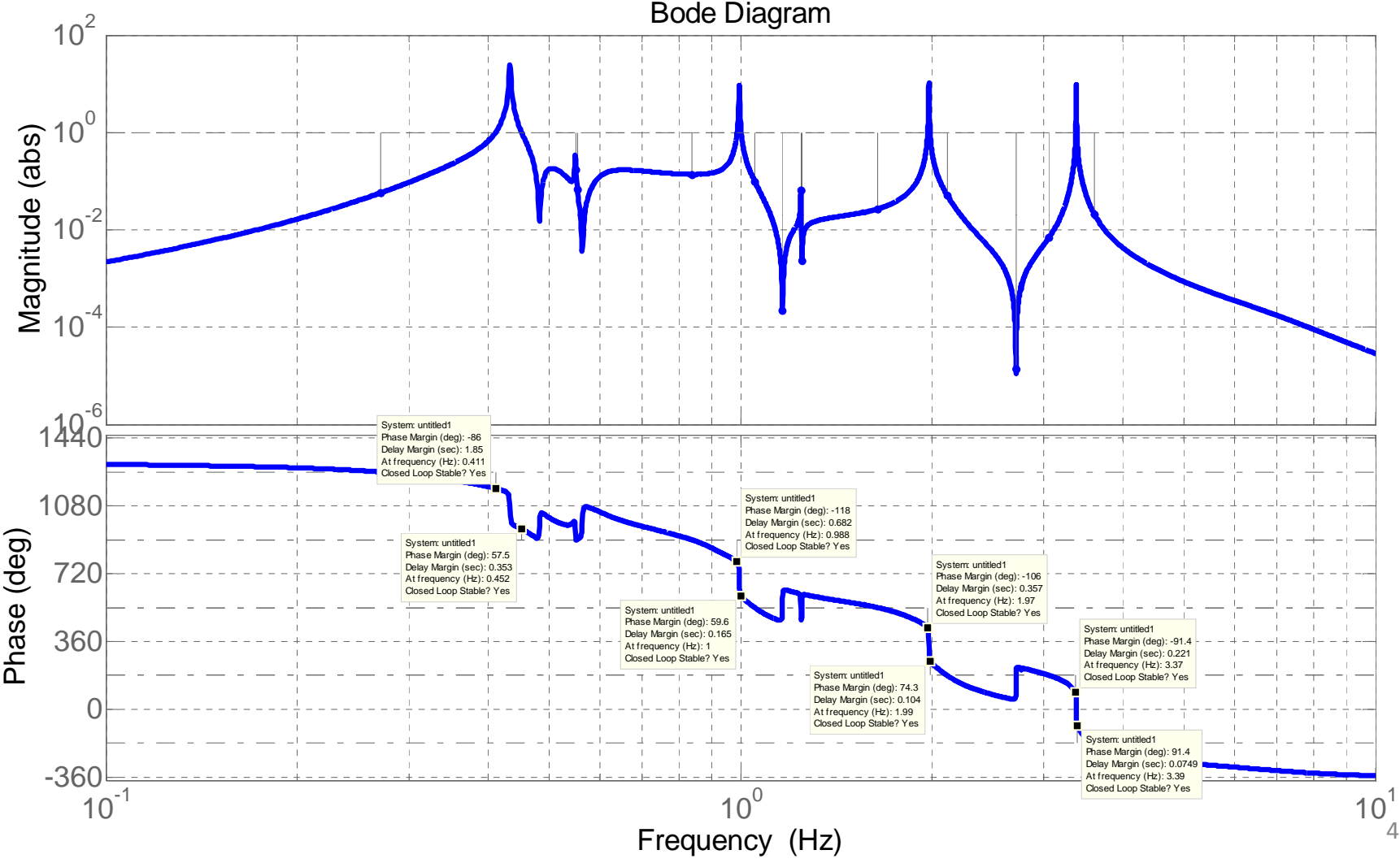


# Low Gain Modal Damping Ringdown

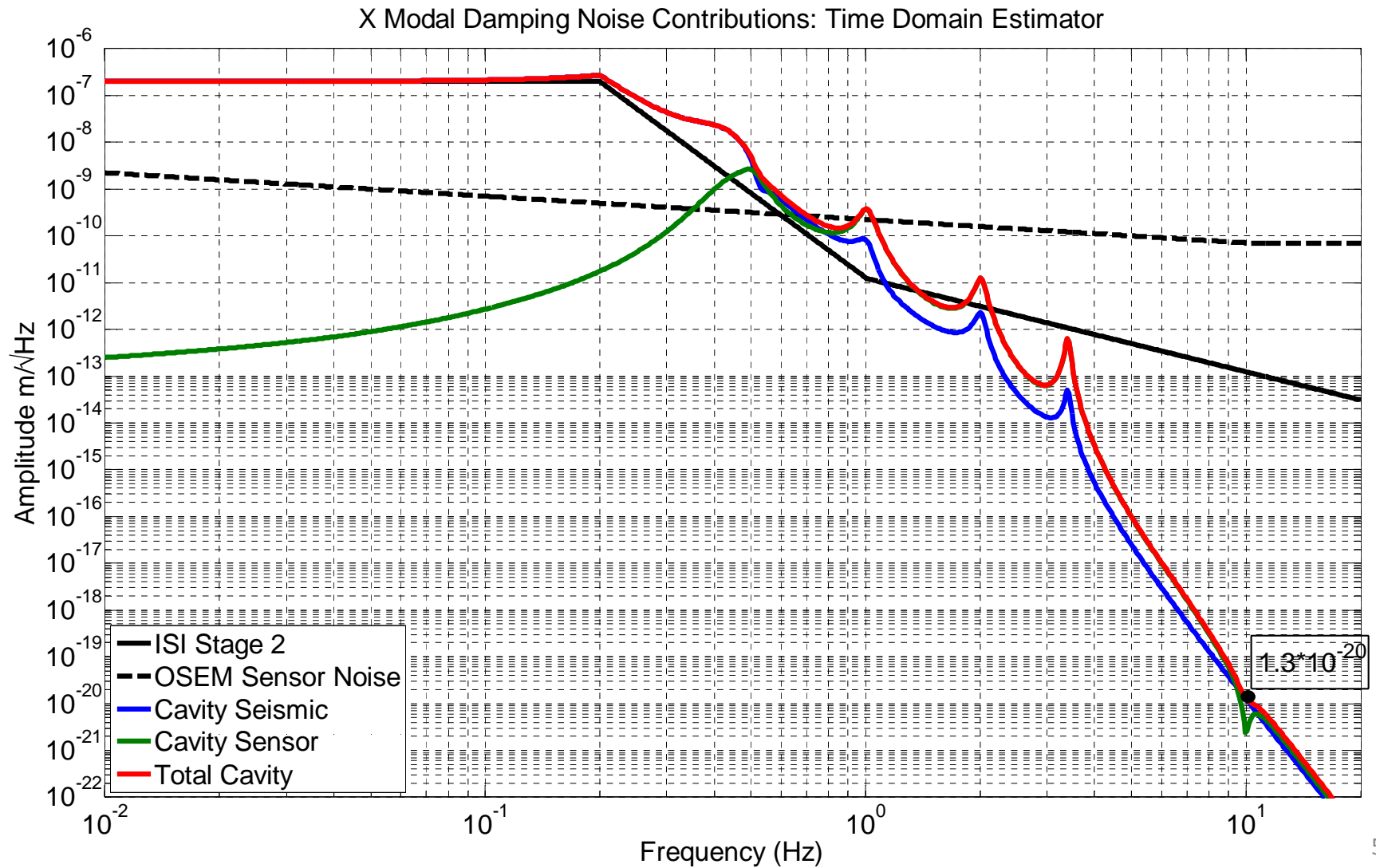
Test Mass Response to Impulse at Suspension Point



# Low Gain Modal Damping Loop Gain

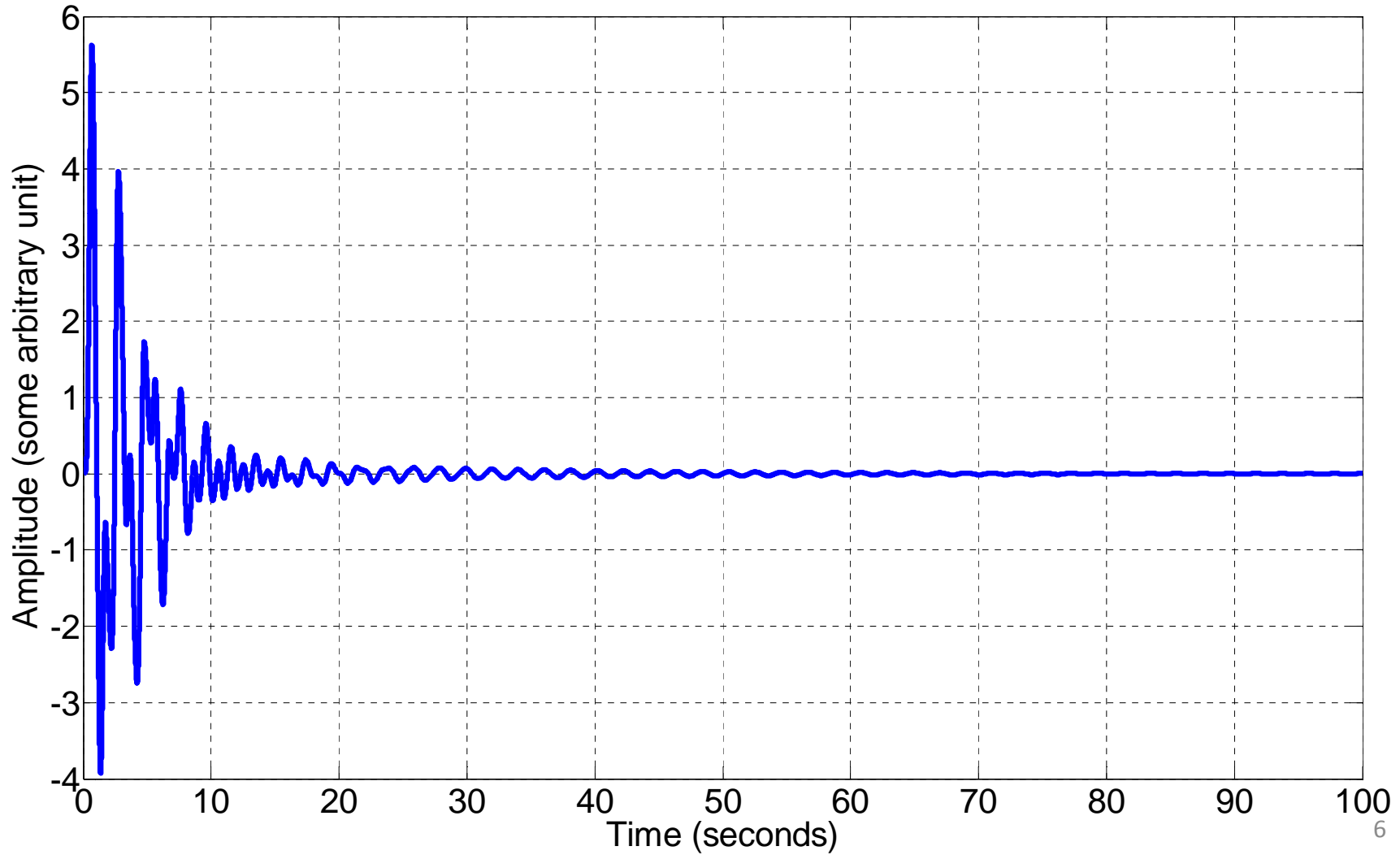


# High Gain Modal Damping Noise

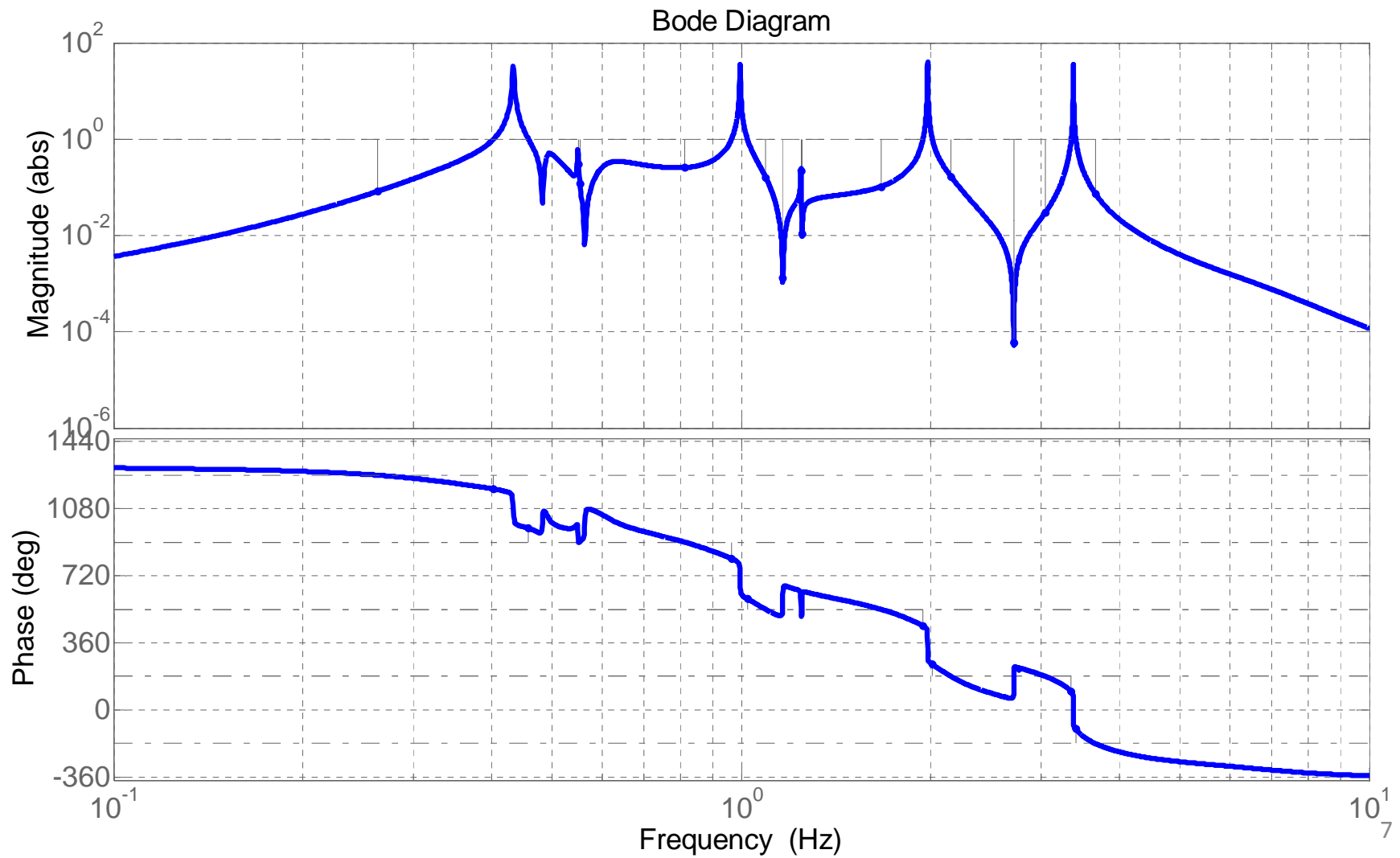


# High Gain Modal Damping Ringdown

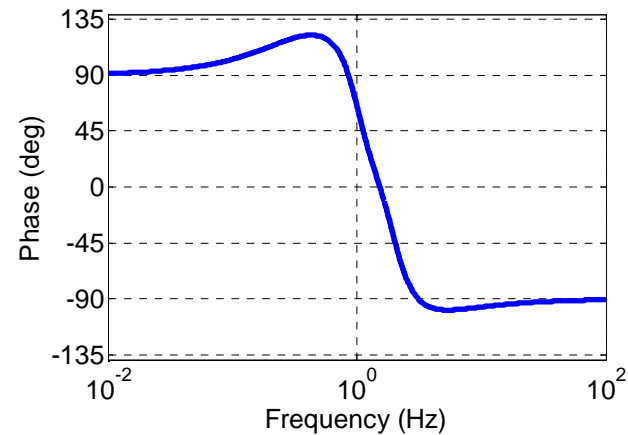
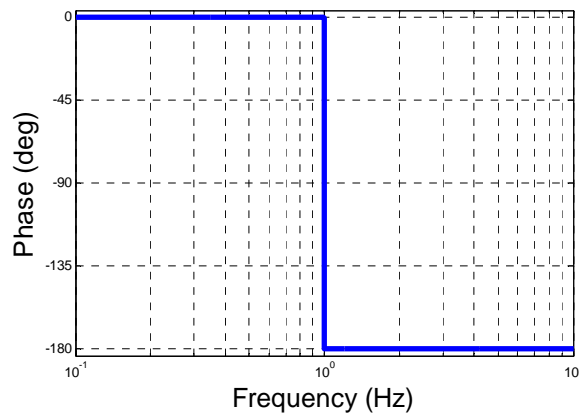
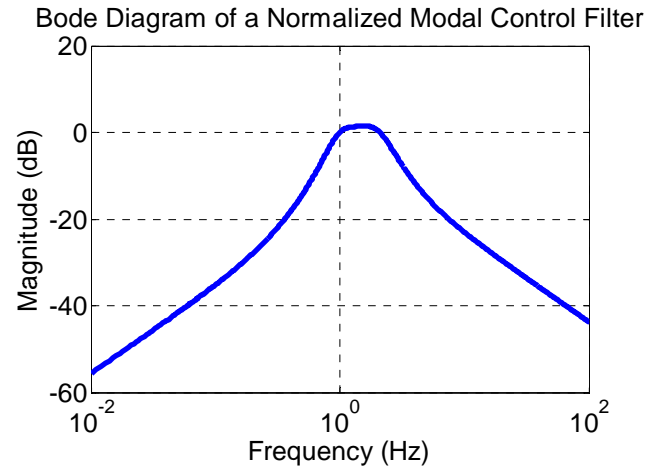
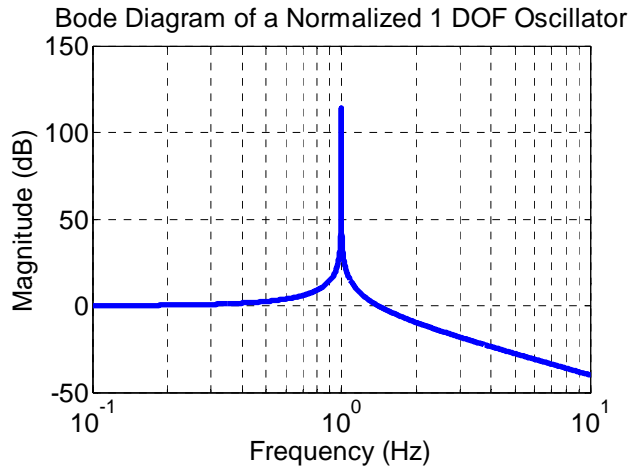
Test Mass Response to Impulse at Suspension Point



# High Gain Modal Damping Loop Gain



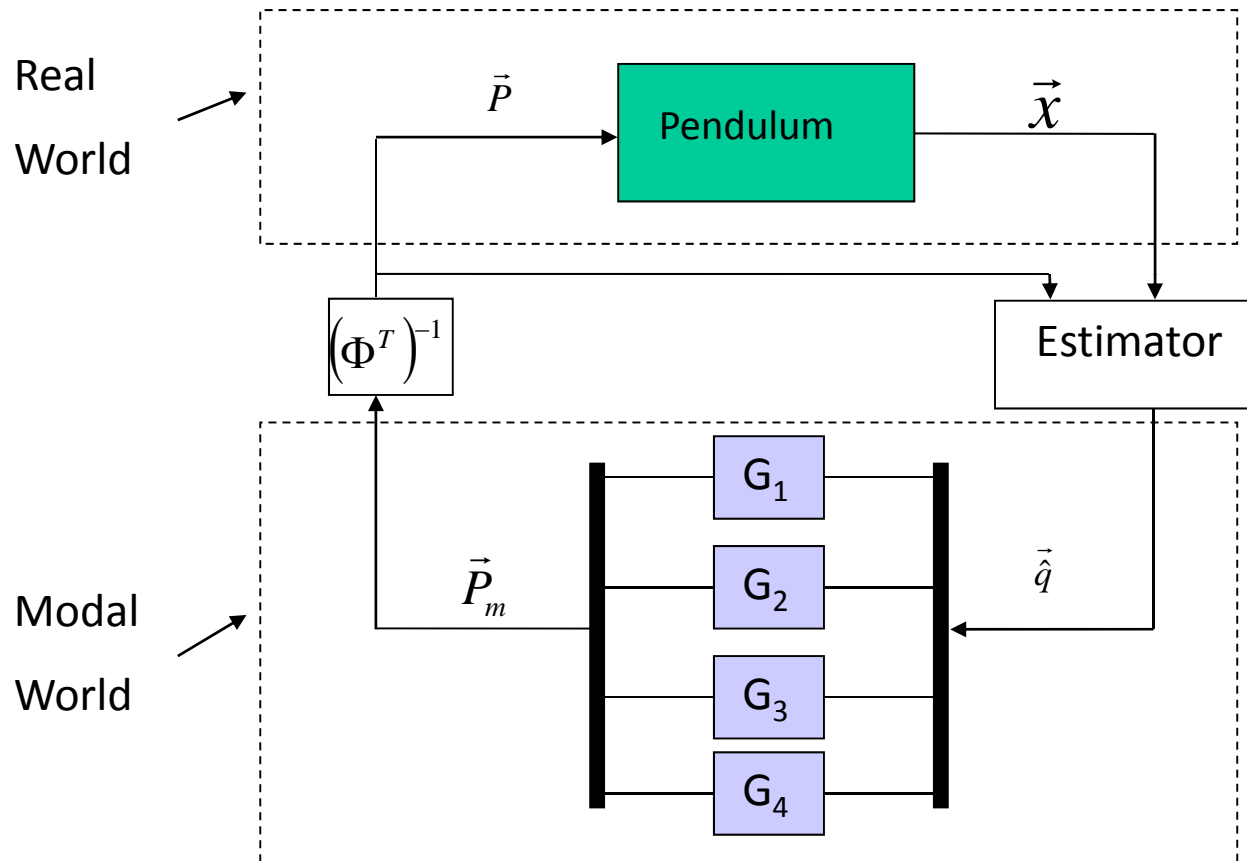
# Modal Damping Filters



The filter includes 2 low passing poles at twice the resonance frequency and a 2 pole, 2 zero gain bump at the resonance. Total of 4 poles and 2 zeros per mode.



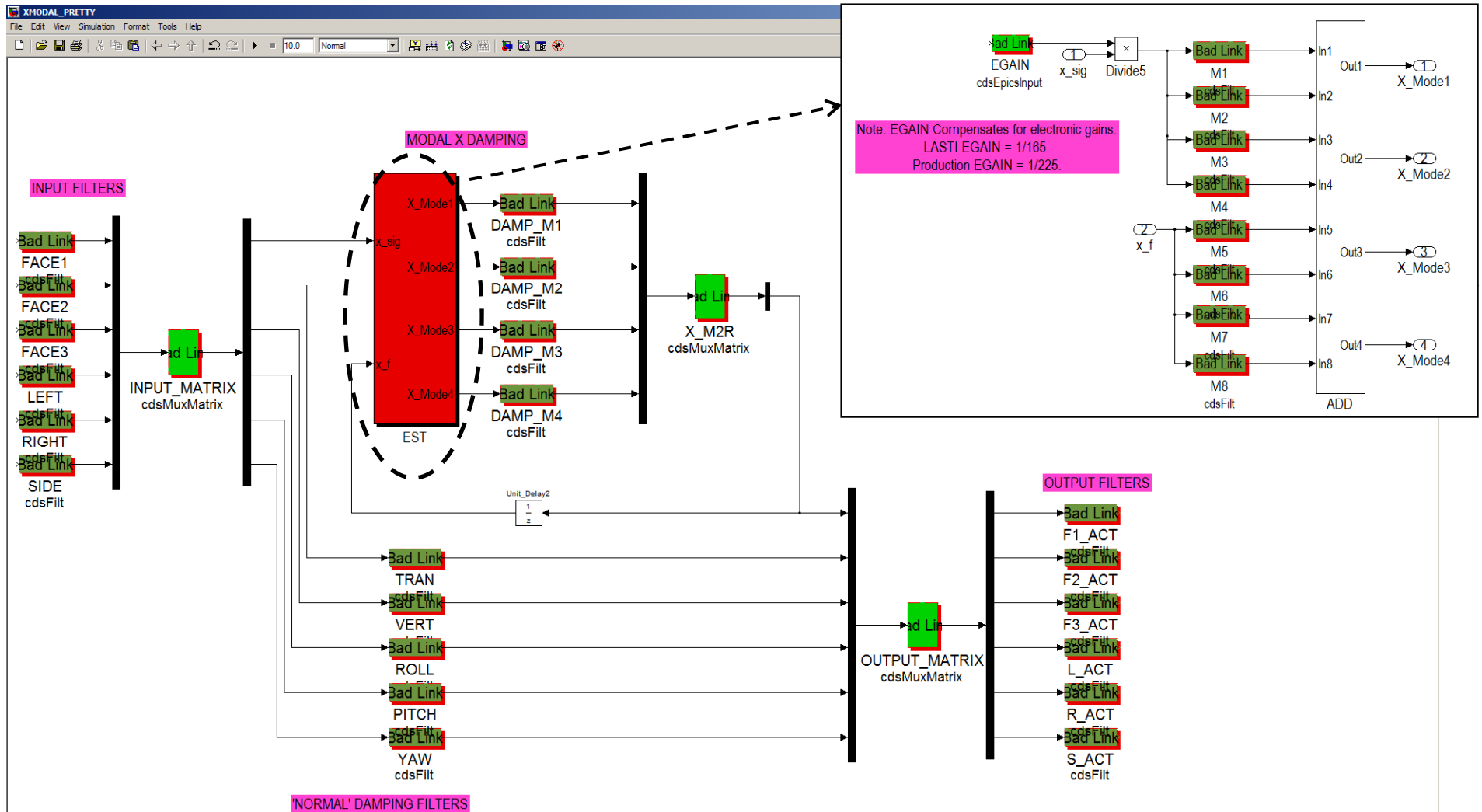
# Modal Damping Block Diagram



$x$  = sensor signals  
 $q$  = vector of modal signals

$P_m$  = modal damping force vector  
 $P$  = Euler damping force

# X Modal RCG Implementation



Pole count for X damping: Estimator = 8 per filter, Dampers = 4 per filter -> Total = 80.0