

Filtering and Navigation

TD1

Luenberger Observer Design of a 2nd Order LTI System

Objectives:

- 1) Design a Luenberger observer for a 2nd order LTI system with given parameters
- 2) Understand the behavior of the observer on different conditions

Tasks:

- 1) Construct a state space representation of a 2nd order LTI system with given ω and ε .
- 2) Simulate the response of the system with different input (a constant input, a square wave and a sine). Change the natural frequency ω and damping factor ε to see how the system will react.
- 3) The system is measured by certain sensor, write the output equation.
- 4) Verify the system is observable.
- 5) Synthesize a Luenberger observer to observe the system. Find out the observer gain L with the required ω_0 and ε_0 and given ω and ε of the system.
- 6) In the real world, the sensor must be corrupted by some noise. Here we suppose it is white, plot the response of the observer.
- 7) Add a model error to the observer and simulate the response.

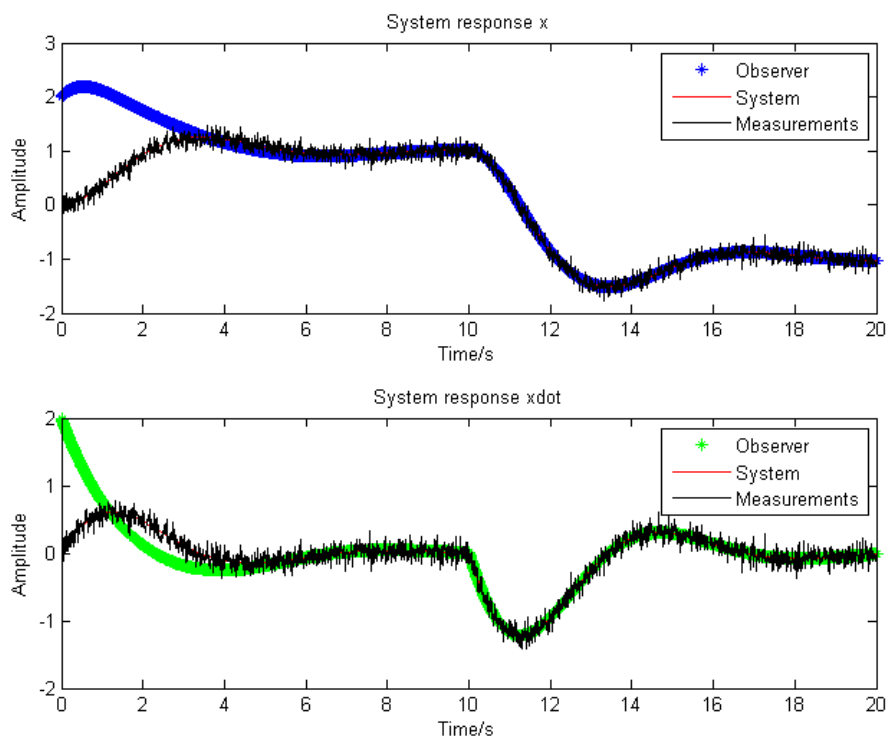
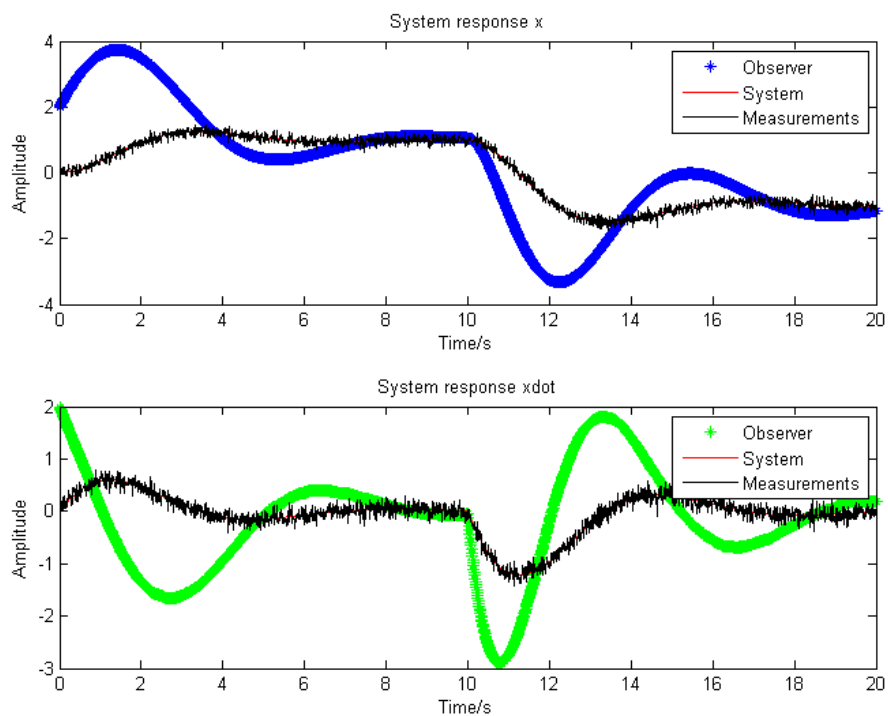


Fig. 1 System & observer response with noisy input


 Fig.2 Observer with system model error, the real system $\omega=1$ and $\varepsilon=0.7$, while with the system error $\omega=2$ and $\varepsilon=0.4$