

# EL41: Filtering and Navigation

## TD1

### Luenberger Observer Design of a 2<sup>nd</sup> Order LTI System

#### Objectives:

- 1) Design a Luenberger observer for a 2<sup>nd</sup> 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 2<sup>nd</sup> order LTI system with given  $\omega$  and  $\varepsilon$ .
- 2) Simulate the response of the system with different input (a constant input, a square wave and a sine). Change the natural frequency  $\omega$  and damping factor  $\varepsilon$  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  $\omega_0$  and  $\varepsilon_0$  and given  $\omega$  and  $\varepsilon$  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.