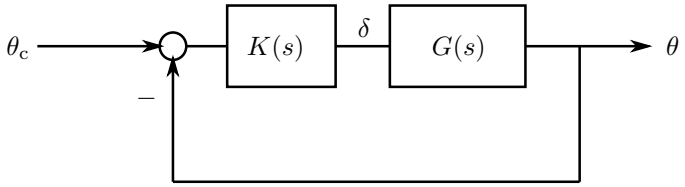
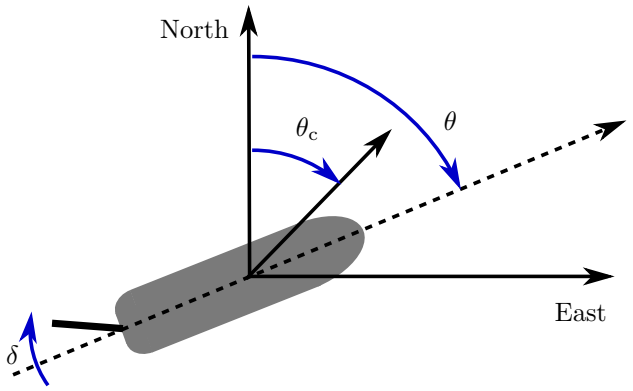
EE363 Automatic Control: Homework #5

1) *Course correction autopilot.* A course correction autopilot for a cruise ship system is shown below. The output variable θ and the control input δ represent the vessel's *heading angle* and the *fin deflection*, respectively. Your job is choose an appropriate controller $K(s)$ that satisfies the following design requirements.

- **Req.#1.** The autopilot should accurately track the commanded heading angle θ_c, up to the step and the ramp command, with zero steady state error.
- **Req.#2.** The closed loop damping should be close to $1/\sqrt{2}$.





A simple plant dynamics from δ to θ is given below by $G(s)$, and fortunately we have several candidates for the control designs as follows.

$$G(s) = \frac{s+1}{s^2(s-0.1)}$$

- P control: $K(s) = K$
- PD control: $K(s) = K\,(2s+1)$
- PI control: $K(s) = K\left(1 + \dfrac{3}{s}\right)$

a) Among the above candidates, choose the one that satisfies **Req.#1**. Justify your answer.

b) From the answer you chose in (a), choose a K that satisfies **Req.#2**, hence meeting all the requirements.