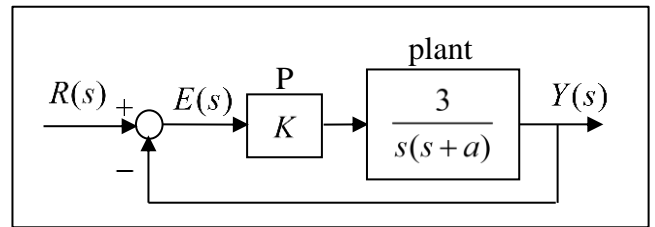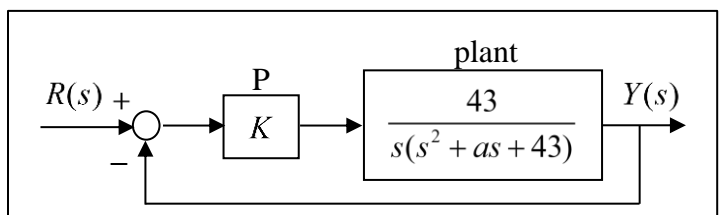**Introductory Control Systems**
Exercises #7 – Parametric Sensitivity

1. A **proportional** ("P") controller is used to control a **2nd order** plant as shown. The system input is $R(s)$ and the system output is $Y(s)$. Find S_a^T and S_K^T the **sensitivities** of the **closed-loop transfer function** $T(s) = \dfrac{Y}{R}(s)$ to changes in parameters a and K.

Answers: $\boxed{S_a^T = \dfrac{-as}{s^2 + as + 3K}}$ $\boxed{S_K^T = \dfrac{s^2 + as}{s^2 + as + 3K}}$

2. A **proportional** ("P") controller is used to control a **3rd order** plant as shown. The system has one input $(R(s))$ and one output $(Y(s))$. Find S_a^T the sensitivity of the closed loop transfer function $T(s) = \dfrac{Y}{R}(s)$ to changes in the parameter a.

Answer: $\boxed{S_a^T = \dfrac{-as^2}{s^3 + as^2 + 43s + 43K}}$