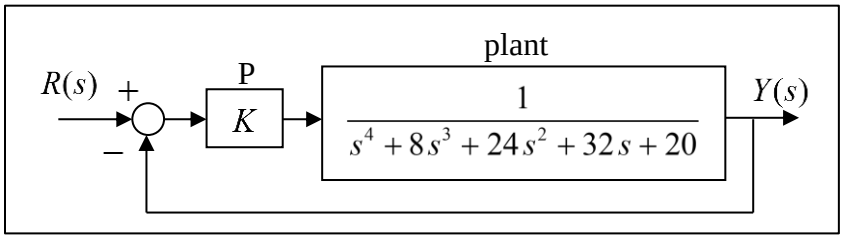
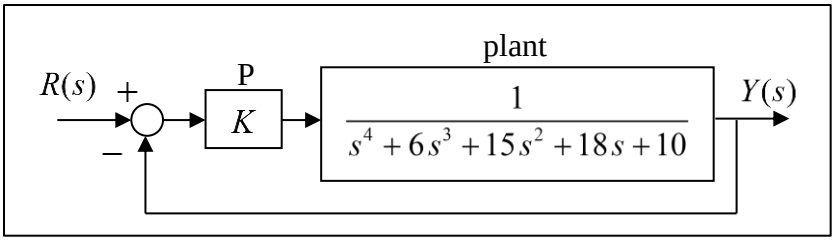
Introductory Control Systems
Exercises #13 – Routh-Hurwitz Stability Analysis

1. A ***proportional*** ("P") controller is used to control a 4th order plant as shown. Formulate the ***Routh-Hurwitz*** (RH) ***array*** for the closed-loop system. Then, ***find*** the ***range*** of values of the parameter *K* for which the closed-loop system is ***stable***.



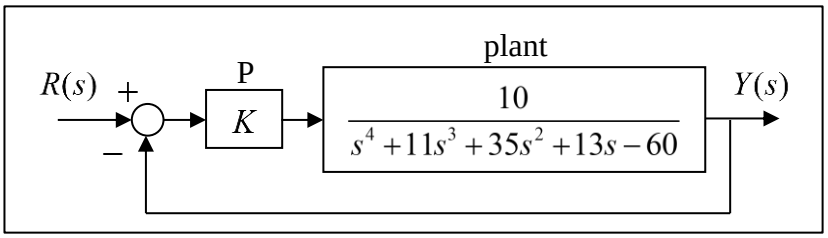
Answers: $b_1 = 20$, $b_2 = 20 + K$, $c_1 = (480 - 8K)/20 = 24 - \frac{2}{5}K$, $d_1 = 20 + K$; $\boxed{-20 < K < 60}$

2. A ***proportional*** ("P") controller is used to control a 4th order plant as shown. Formulate the ***Routh-Hurwitz*** (RH) ***array*** for the closed-loop system. Then, ***find*** the ***range*** of values of the parameter *K* for which the closed-loop system is ***stable***.



Answers: $b_1 = 12$, $b_2 = 10 + K$, $c_1 = (26 - K)/2$, $d_1 = 10 + K$; $\boxed{-10 < K < 26}$

3. A ***proportional*** ("P") controller is used to control a 4th order plant as shown. Formulate the ***Routh-Hurwitz*** (RH) ***array*** for the closed-loop system. Then, ***find*** the ***range*** of values of the parameter *K* for which the closed-loop system is ***stable***.



Answers: $b_1 = 33.82$, $b_2 = 10K - 60$, $c_1 = 32.52 - 3.253K$, $d_1 = 10K - 60$; $\boxed{6 < K < 10}$