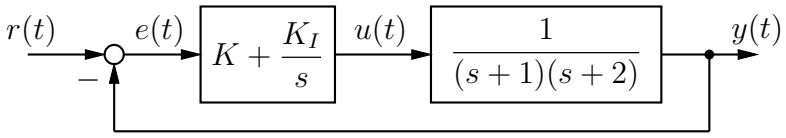
INC 341 Feedback Control Systems **Home Work 4**
Assign: 19 Sep 2016 **No Due for 3AE, 3A, 3WIL:**

Instruction: Hand in your work with name and code by hand before the class is started. DO NOT copy homework from your classmates or lend it to others. Anyone who violates this regulation will be given -10 for the homework.

1. Find the range of the controller gains (K, K_I) so that the PI (proportional-integral) feedback system



is stable.

Solution:

The characteristic equation of the closed-loop system is

$$s^3 + 3s^2 + (2 + K)s + K_I = 0$$

The corresponding Routh array is

$$\begin{array}{c|cc} s^3 & 1 & 2+K \\ s^2 & 3 & K_I \\ s & (6+3K-K_I)/3 & \\ s^0 & K_I & \end{array}$$

For asymptotic stability we must have

$$K_I > 0 \qquad \text{and} \qquad K > \frac{1}{3}K_I - 2$$

□