1 Closed loop systems

Consider the block diagram as shown in the figure below. Calculate the closed-loop transfer function $T$ as well as its sensitivity with respect to $G$, i.e., $S_T^G$, when

1) $G(s) = \frac{1}{s+1}, H(s) = 1$

2) $G(s) = \frac{1}{s+1}, H(s) = -2$

3) $G(s) = \frac{1}{s^2+2s}, H(s) = 1$

![Block Diagram]

2 Routh-Hurwitz stability criterion

1. Use the Routh-Hurwitz stability criterion to determine the number of roots in the left half plane
   a) $s^4 + 2s^2 + 1 = 0$
   b) $s^4 + s^3 + s + 0.5 = 0$
   c) $s^4 + 2s^3 + 3s^2 + 2s + 4 = 0$

2. Use the Routh-Hurwitz stability criterion to determine the range of $K$ such that all the roots of

   $s^3 + s^2 + s + K = 0$

are in the left half plane.