Robust Control — based on an 2015 exam

1. Consider the scheme of the figure below. The gray box is the controller and notice that it contains a copy of the plant P. Design methods based on such controllers are known as "internal model control". They are quite popular because of some striking features:

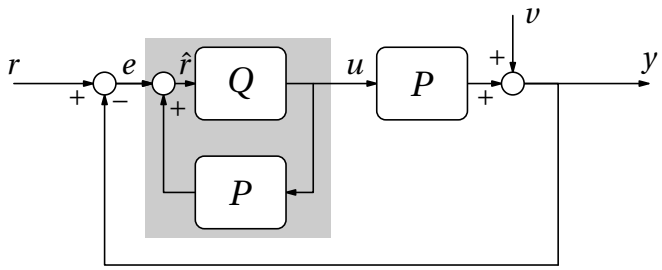
   (a) Determine the transfer function from r to y.
   (This should be correct for multi-input-multi-output systems).

   (b) Determine the transfer function from v to y.

   (c) Suppose P is SISO and suppose that P is stable. Show that the closed loop is stable if-and-only-if Q is stable.

   (d) Suppose $P(s) = 1/(s^2+2s+3)$. On what condition on $Q(s)$ is the DC-gain of the mapping from r to y equal to 1?

   (e) Use the above to design a controller $K(s)$ with integrating action for $P(s) = 1/(s^2+2s+3)$ and that achieves a bandwidth of at least $B = 4$.



2. Lecture notes exercise 4.5

3. Lecture notes exercise 5.3

4. Lecture notes exercise 7.3

5. Lecture notes exercise 8.4

6. Lecture notes exercise 9.6

problem:	1	2	3	4	5	6
points:	3+1+3+2+4	1+2	3	4	2+2+2	3

Grade: $= 1 + 9\frac{p}{p_{\max}}$