

ECE 421

Practice Root Locus Problems

Problem #1

$$G_{p_1}(s) = \frac{K(s+3)}{s(s+p_1)(s^2+4s+5)} = \frac{K(s+3)}{s(s+p_1)(s+2+j)(s+2-j)} \quad (1)$$

$$p_1 \in [4, 3.5, 3.125, 2.875, 2.75, 2.5, 2, 1, -1] \quad (2)$$

%MATLAB Code:

```
np1 = [1 3];
p1 = [4 3.5 3.125 2.875 2.75 2.5 2 1 -1];
for i = 1:length(p1)
dp1 = conv([1 p1(i) 0],[1 4 5]);
figure(1),subplot(3,3,i),rlocus(np1,dp1),axis([-6 6 -6 6])
text(1,1.5,['p_1 = ' num2str(p1(i))])
end
```

Problem #2

$$G_{p_2}(s) = \frac{K(s+1)}{s^2(s+p_2)} \quad (3)$$

$$p_2 \in [10, 9, 8, 6, 4, 2, 1.5, 0.5, -1] \quad (4)$$

%MATLAB Code:

```
np2 = [1 1];
p2 = [10 9 8 6 4 2 1.5 0.5 -1];
for i = 1:length(p2)
dp2 = [1 p2(i) 0 0];
figure(2),subplot(3,3,i),rlocus(np2,dp2),axis([-12 12 -12 12])
text(2,2,['p_2 = ' num2str(p2(i))])
end
```

Problem #3

$$G_{p_3}(s) = \frac{K(s+z_3)}{s(s+1)(s+2)(s+3)} \quad (5)$$

$$z_3 \in [8, 4, 2.75, 2.25, 1.75, 1.25, 0.75, 0.1, -1] \quad (6)$$

%MATLAB Code:

```
dp3 = [1 6 11 6 0];
z3 = [8 4 2.75 2.25 1.75 1.25 0.75 0.1 -1];
for i = 1:length(z3)
np3 = [1 z3(i)];
figure(3),subplot(3,3,i),rlocus(np3,dp3),axis([-20 10 -15 15])
text(-15,-10,['z_3 = ' num2str(z3(i))])
end
```