

ControlsHW7

ras70

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Remarks about Problem 1A and 1B

The rule being utilized in parts 1A and 1B is the rule stating that real axis segments exist to the left of an odd number of real axis finite open loop poles/zeros. In the case of 1A, -1.28 is to the left of the first pole (-1), and thus is on the root locus. In the case 1B, -2.28 is to the left of the second pole/zero. Therefore, it is not on the root locus.

To tell if a point is on the root locus the difference of the sum of the angle of the zero lengths and the sum of the angle of the pole lengths need to be an odd multiple of 180° . Let p be a point on the real axis in which we are trying to see if it lies on the root locus. Due to symmetry all poles and zeros not on the root axis contribute zero angle. All poles/zeros to the right of p have a negative 180° angle to p and all pole/zeros to the left of p have a 0° angle to p . Let a be the number of zeros to the right of p , b be the number of zeros to the left of p , c be the number of poles to the right of p , and d be the number of poles to the left of p .

The angle of M is given as:

$$\angle M = (180 * a + 0 * b) - (180 * c + 0 * d) = 180(a - c)$$

For the angle to be an odd multiple of 180° , $a - c$ must be odd. This intuitively shows where the real axis rule comes from.