**Solution1 (6)**

* The plant poles: -2.5
* The desired system poles: desired pole real part

The open-loop system did not meet the desired specifications, we need to add a controller to have a new system.

1

1. The closed loop transfer function:

1

1. The closed loop caracteristic equation:

1

1. The PI controller gains:we have

We have

1

1

1

**Solution 2 (7)**

1

1. The poles of the open-loop system are:
2. Portion between -1 and -3 and another is the left of -5.

1

1. Since n-m=3, we have three asymptotes

1

1. Breakaway point: -1.85 (and -4.16 rejected).

1

1. Imaginary axis crossing: characteristic equation

0.5

and the Routh array:

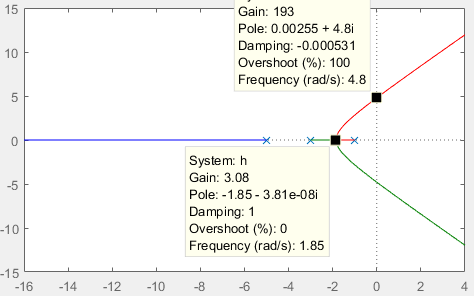
|  |  |
| --- | --- |
|  |  |

only row can be zero: ,

0.5

Forming the even polynomial by using the row (above) with gives

1



1

**Solution3 (7)**

1. The uncompensated system position constant error:

1

*.*

1

.

1. The desired error:

1

1

1. Lag compensator: we have

1

1

1. The Lag compensator transfer function

1