

Homework assignment 2-1

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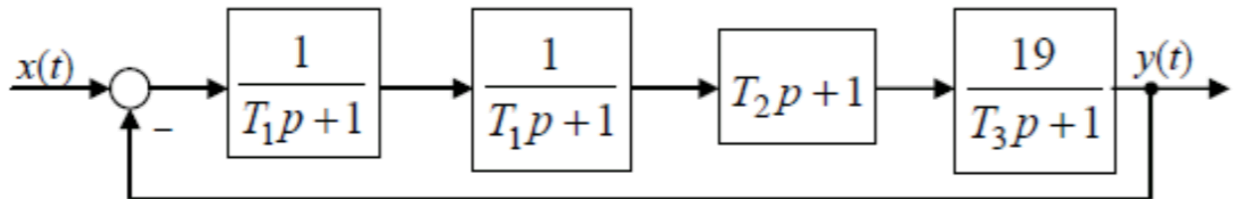
Variant #6

$$T_1 = 3.75 \text{ sec}$$

$$T_2 = 1.5 \text{ sec}$$

$$T_3 = 0.15 \text{ sec}$$

1) Static control system



$$W(p) = \frac{28.5p + 19}{(0.15p + 1)(3.75p + 1)^2}$$

$$\Phi(p) = \frac{13.5111p + 9.00741}{p^3 + 7.2p^2 + 17.1378p + 9.48148}$$

Maclaurin series:

$$0.95 - 0.292125p - 0.19339p^2 + 0.47119p^3 - 0.67401p^4 + O(p^5)$$

$$C_0 = 0.95$$

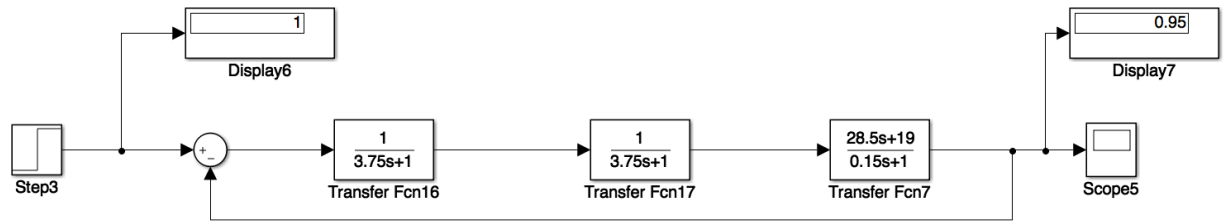
$$C_1 = -0.292125$$

$$C_2 = -0.19339$$

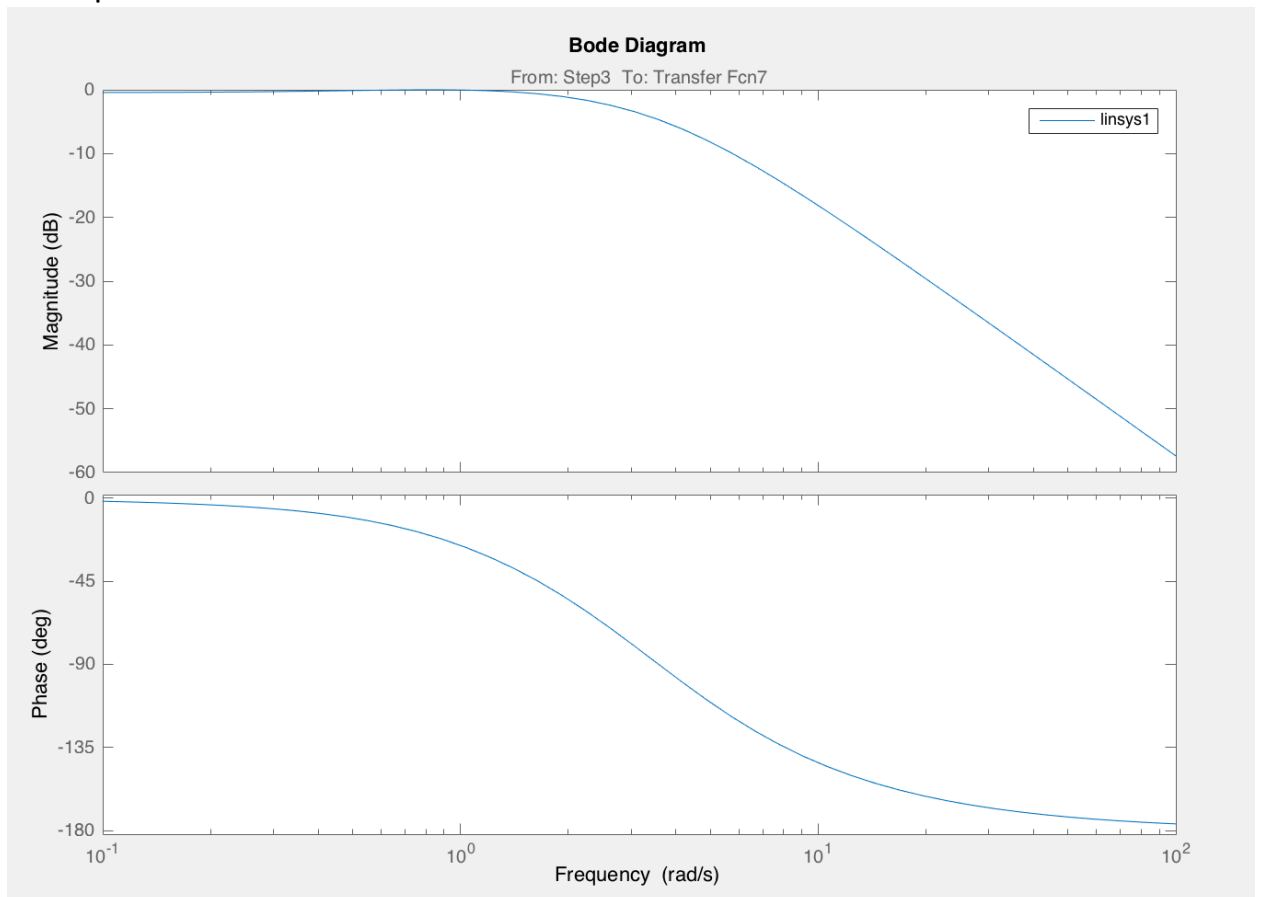
$$C_3 = 0.47119$$

$$C_4 = -0.67401$$

1.a) $g(t) = 1(t)$



Code plot :



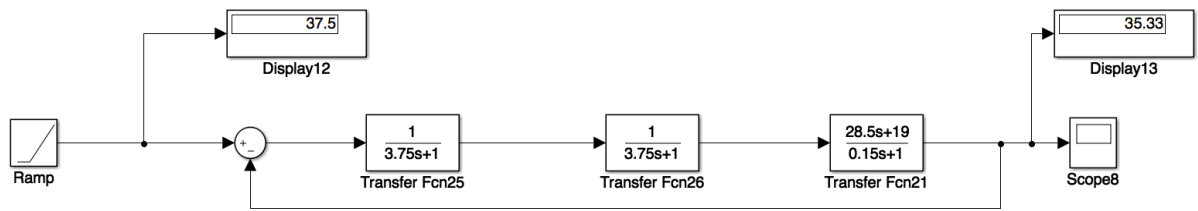
measured result:

$$\varepsilon = 1 - 0.95 = 0.05$$

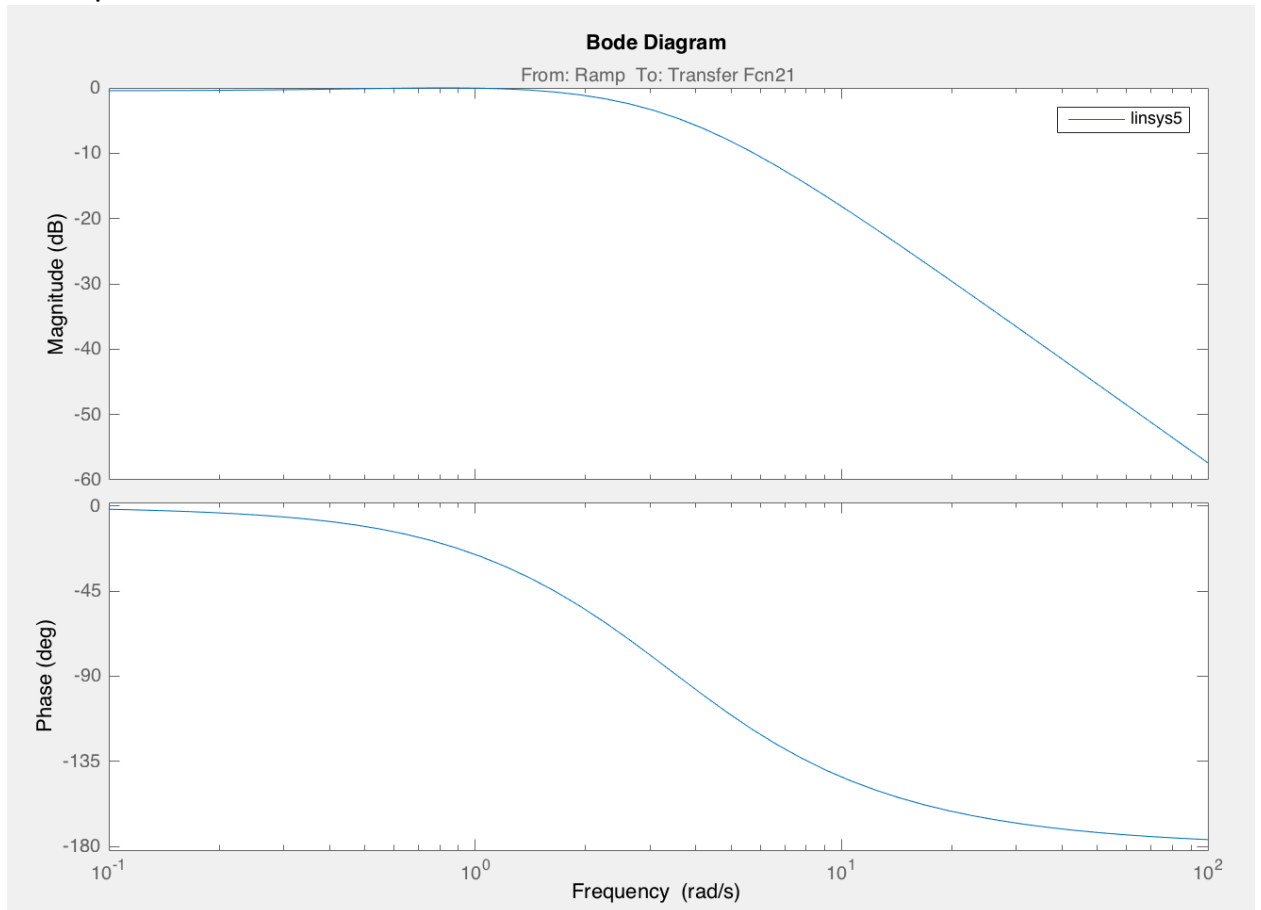
calculated result:

$$\varepsilon = 1 - C_0 g(t) = 1 - 0.95 * 1 = 0.05$$

1.b) $g(t) = t1(t)$



Bode plot:



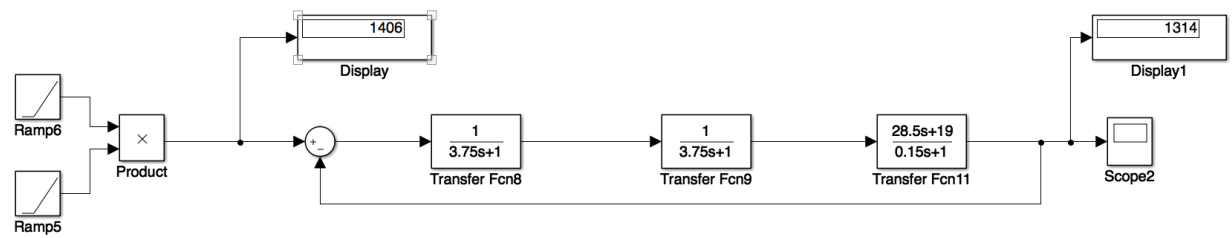
measured result:

$$\varepsilon = 37.5 - 35.33 = 2.17$$

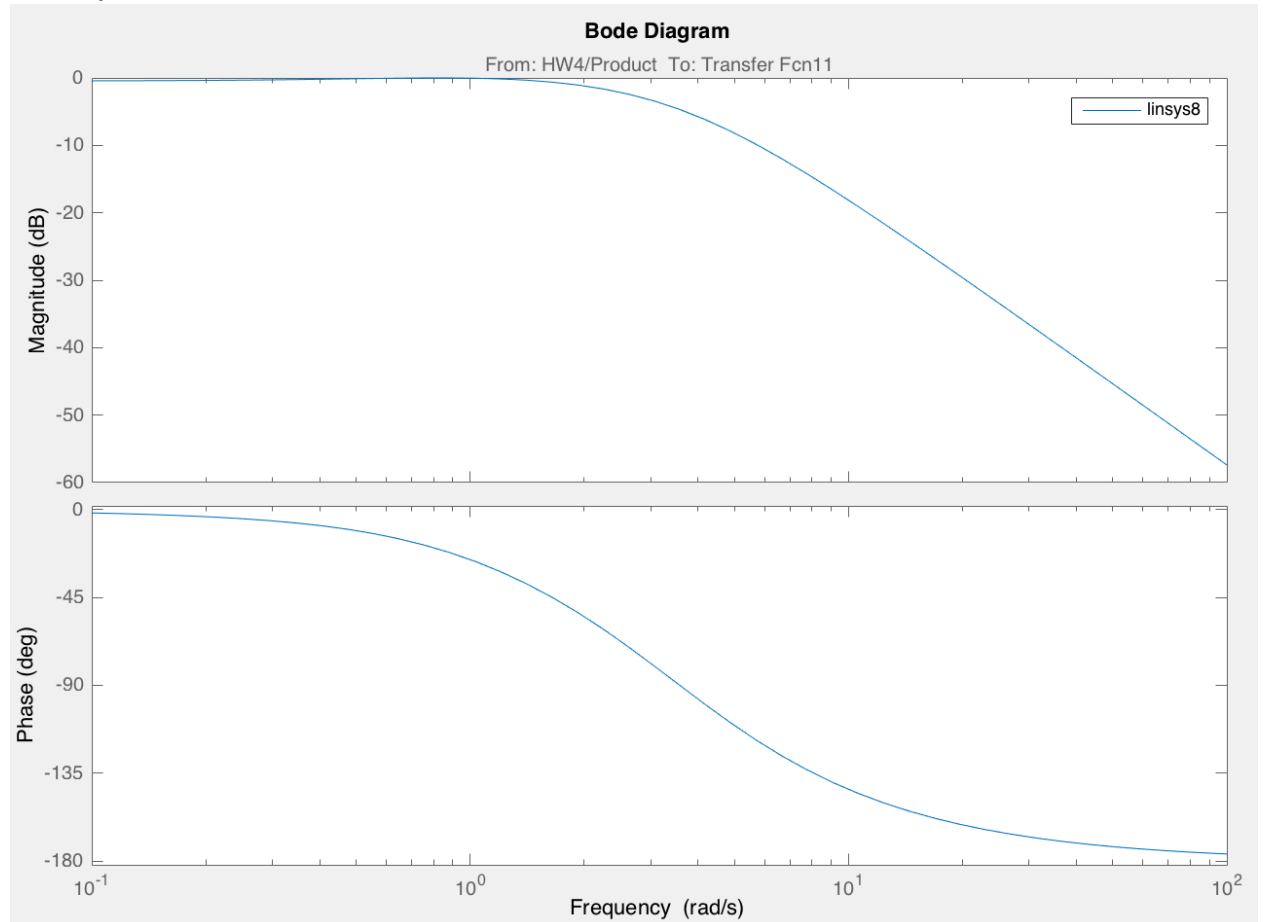
calculated result:

$$\varepsilon = 37.5 - C_0 g(t) - C_1 g'(t) = 37.5 - 0.95 \cdot 37.5 + 0.292125 = 2.167125$$

1.c) $g(t) = t^2 1(t)$



Bode plot :



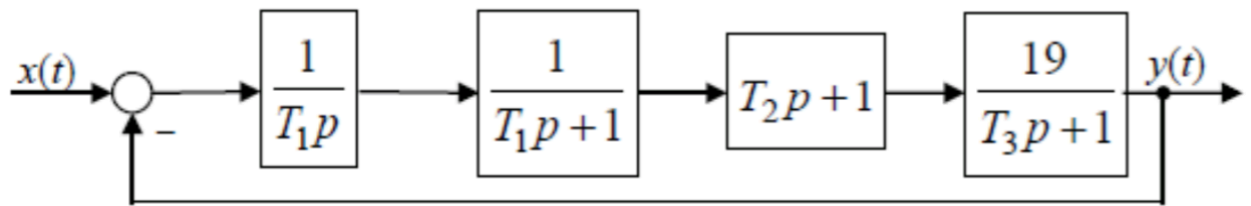
measured result:

$$\varepsilon = 1406 - 1314 = 92$$

calculated result:

$$\varepsilon = 1406 - C_0 g(t) - C_1 \dot{g}(t) - C_2 \ddot{g}(t)/2 = 1406 - 0.95 \cdot 1406 + 0.292125 \cdot 75 + 0.19339 \cdot 2/2 = 92,402765$$

2) Astatic of 1st order control system



$$W(p) = \frac{19(3p + 1)}{(0.3p + 1)(7.5p + 1)^2 \left(\frac{19(3p + 1)}{(0.3p + 1)(7.5p + 1)^2} + 1 \right)}$$

$$\Phi(p) = \frac{3.37778p + 1.12593}{p^3 + 3.6p^2 + 4.28444p + 1.18519}$$

Maclaurin series:

$$1. - 0.197368p - 0.43473p^2 + 0.778799p^3 - 0.965369p^4 + O(p^5)$$

$$C_0 = 1$$

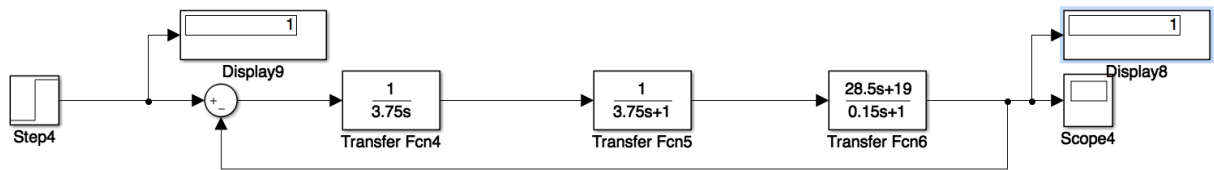
$$C_1 = -0.197368$$

$$C_2 = -0.43473$$

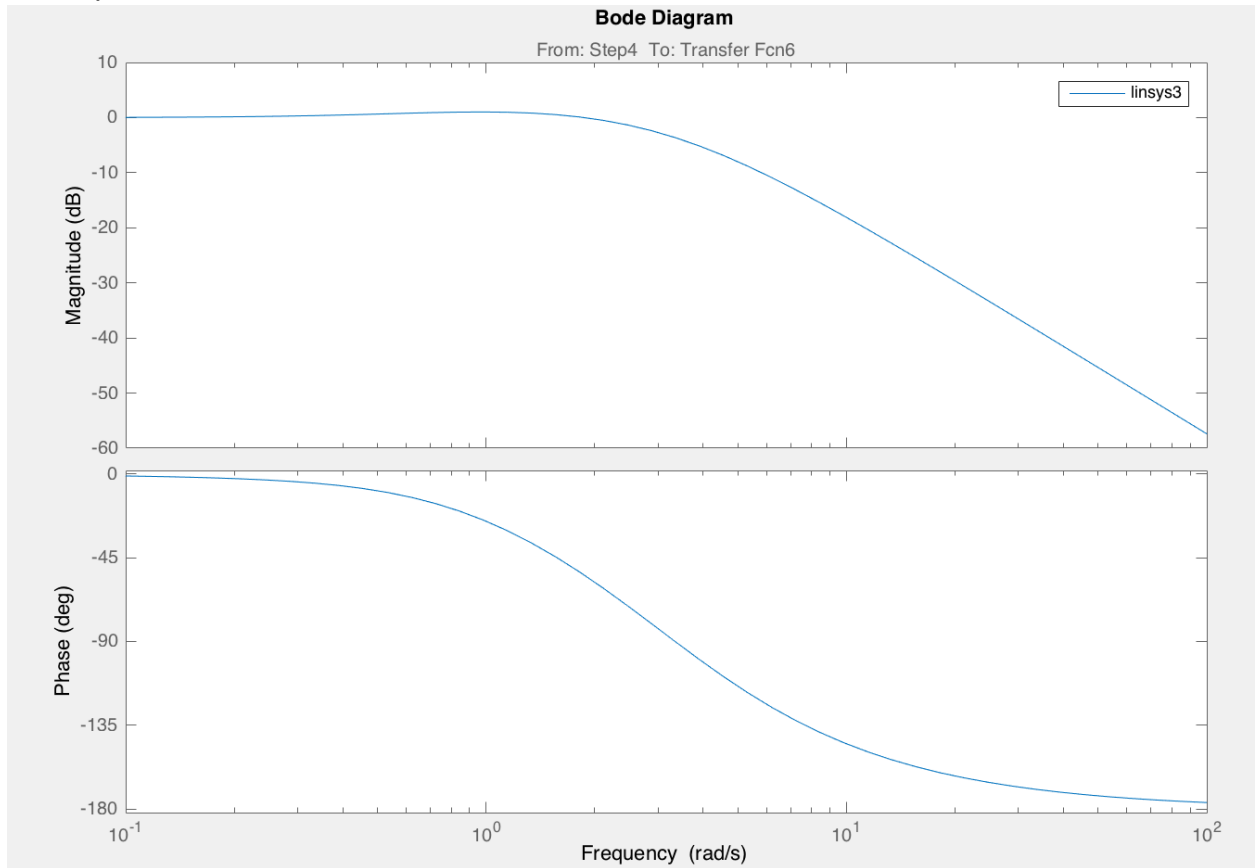
$$C_3 = 0.778799$$

$$C_4 = -0.965369$$

2.a) $g(t) = 1(t)$



Bode plot:



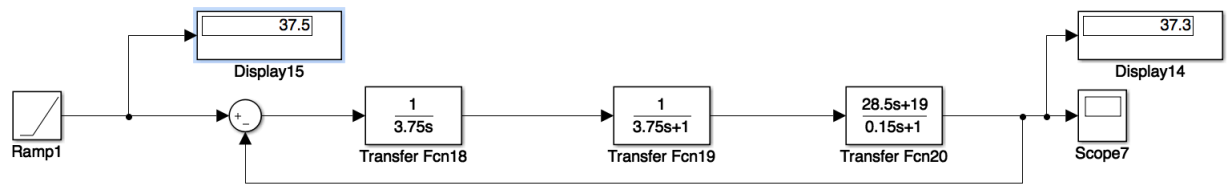
measured result:

$$\varepsilon = 1 - 1 = 0$$

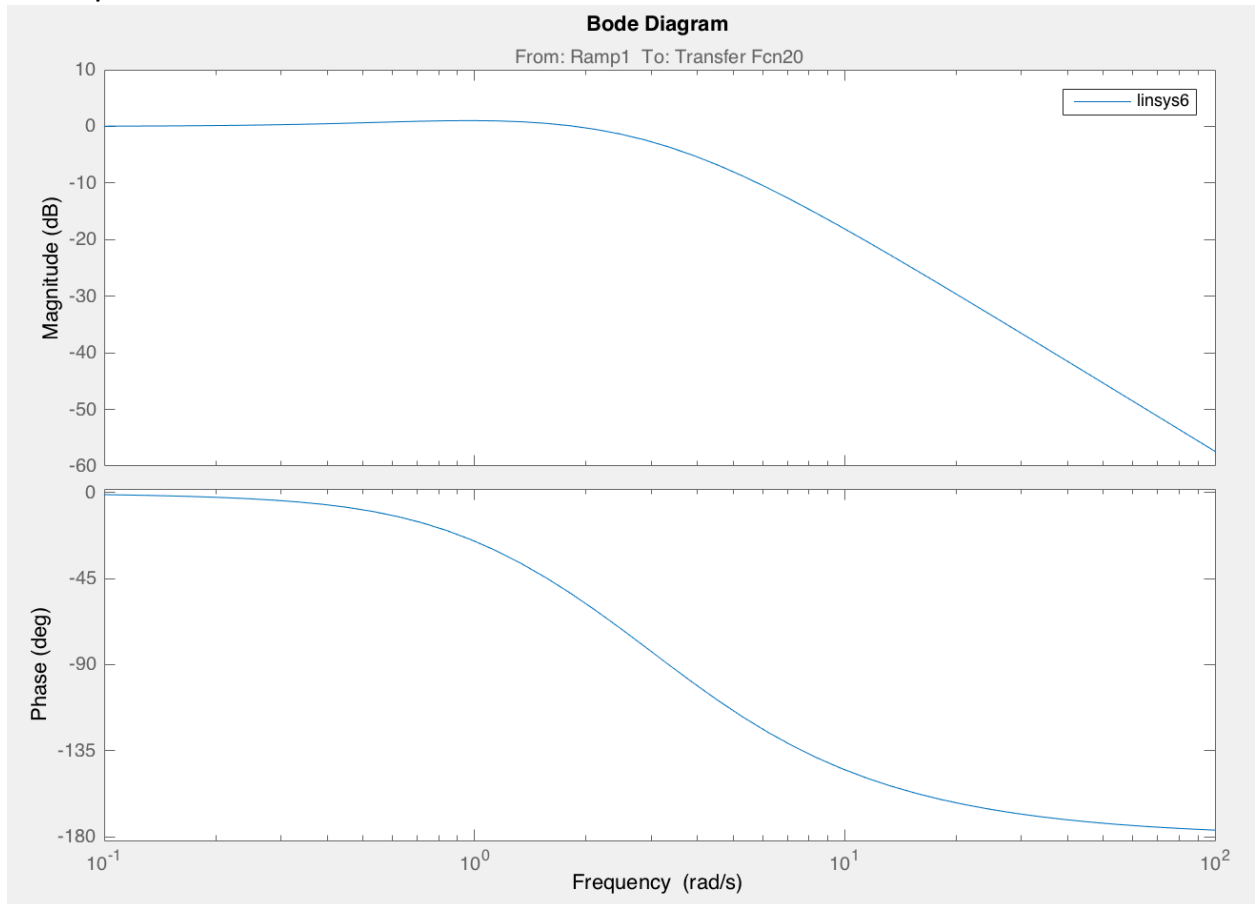
calculated result:

$$\varepsilon = 1 - C_0 g(t) = 1 - 1 * 1 = 0$$

2.b) $g(t) = t1(t)$



Bode plot:



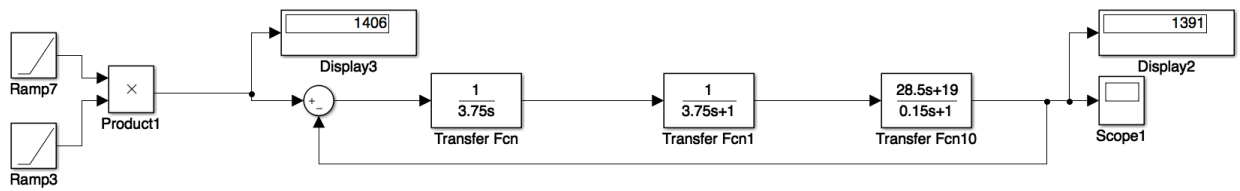
measured result:

$$\varepsilon = 37.5 - 37.3 = 0.2$$

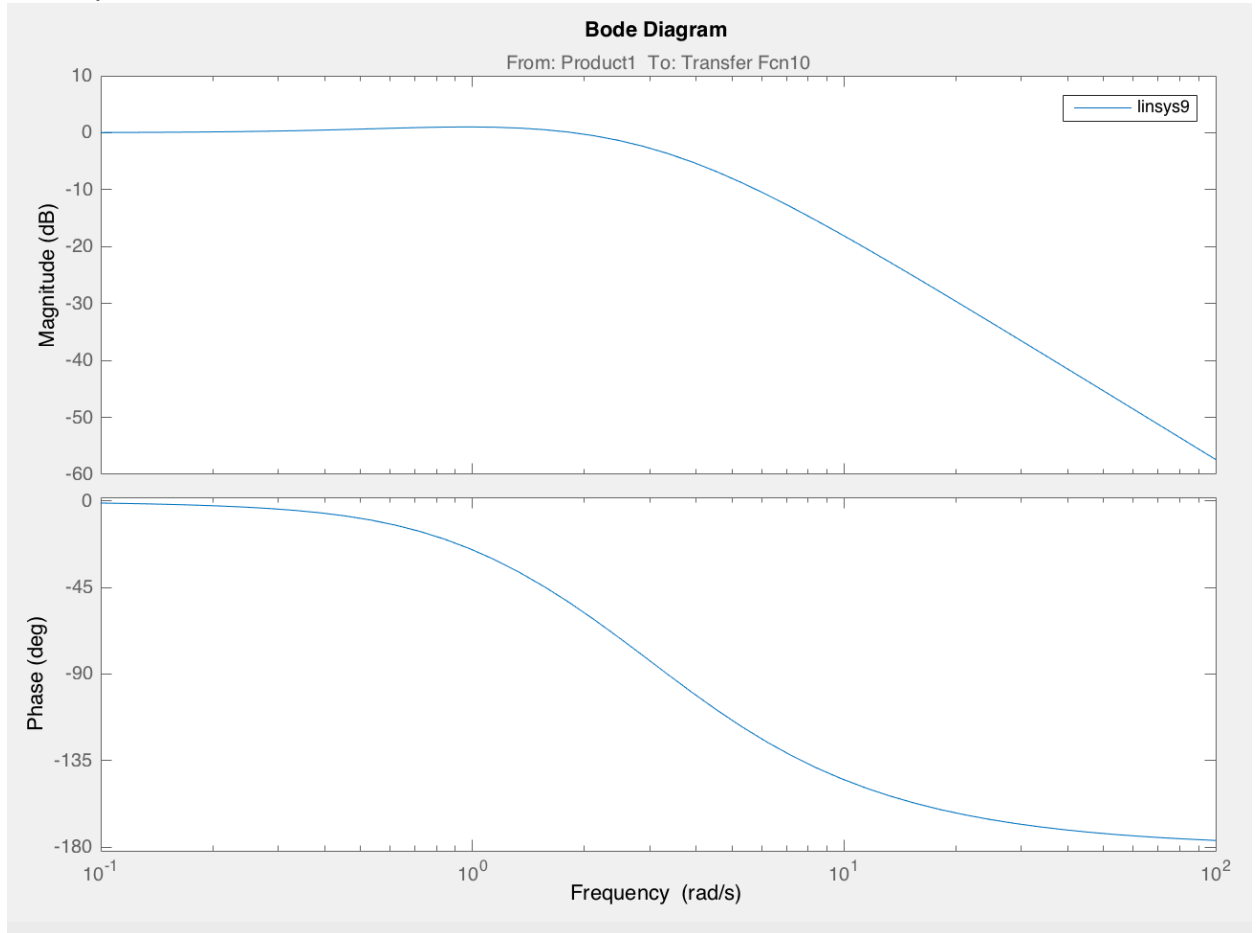
calculated result:

$$\varepsilon = 37.5 - C_0 g(t) - C_1 g'(t) = 37.5 - 1 \cdot 37.5 + 0.58425 = 0$$

2.c) $g(t) = t^2 1(t)$



Bode plot :



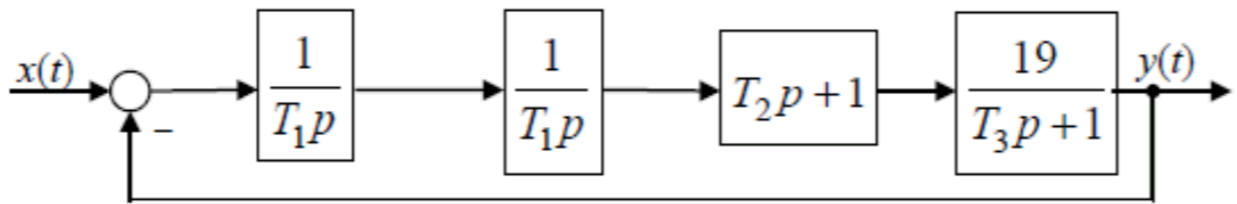
measured result:

$$\varepsilon = 1406 - 1391 = 15$$

calculated result:

$$\varepsilon = 1406 - C_0 g(t) - C_1 g'(t) - C_2 g''(t)/2 = 1406 - 1 \cdot 1406 + 0.197368 \cdot 75 + 0.43473 = 15.23733$$

3) Astatic of 2nd order control system



$$W(p) = \frac{0.0711111 (28.5 p + 19)}{(0.15 p + 1) p^2}$$

$$\Phi(p) = \frac{13.5111 p + 9.00741}{p^3 + 6.66667 p^2 + 13.5111 p + 9.00741}$$

Maclaurin series:

$$1. - 0.740132 p^2 + 0.999178 p^3 - 0.950972 p^4 + O(p^5)$$

$$C_0 = 1$$

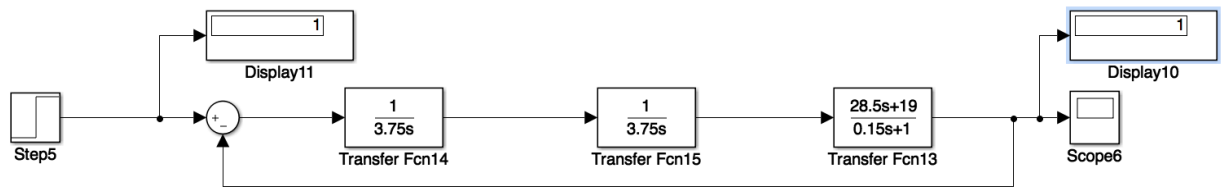
$$C_1 = 0$$

$$C_2 = -0.740132$$

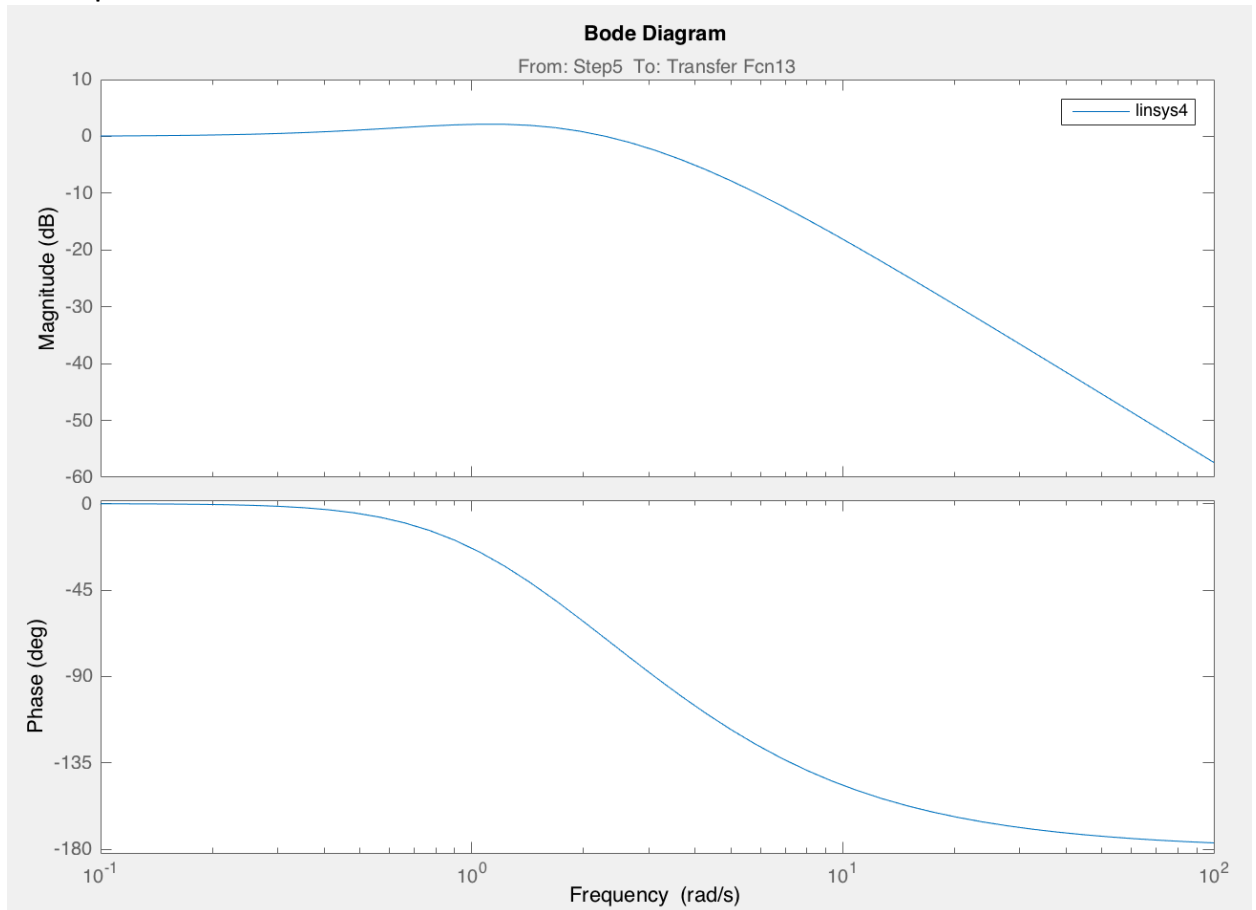
$$C_3 = 0.999178$$

$$C_4 = -0.95097$$

3.a) $g(t) = 1(t)$



Bode plot:



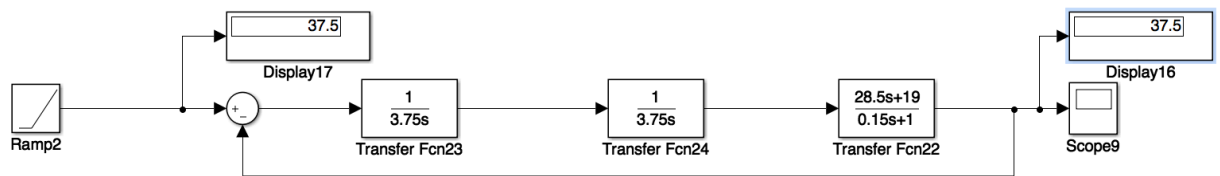
measured result:

$$\varepsilon = 1 - 1 = 0$$

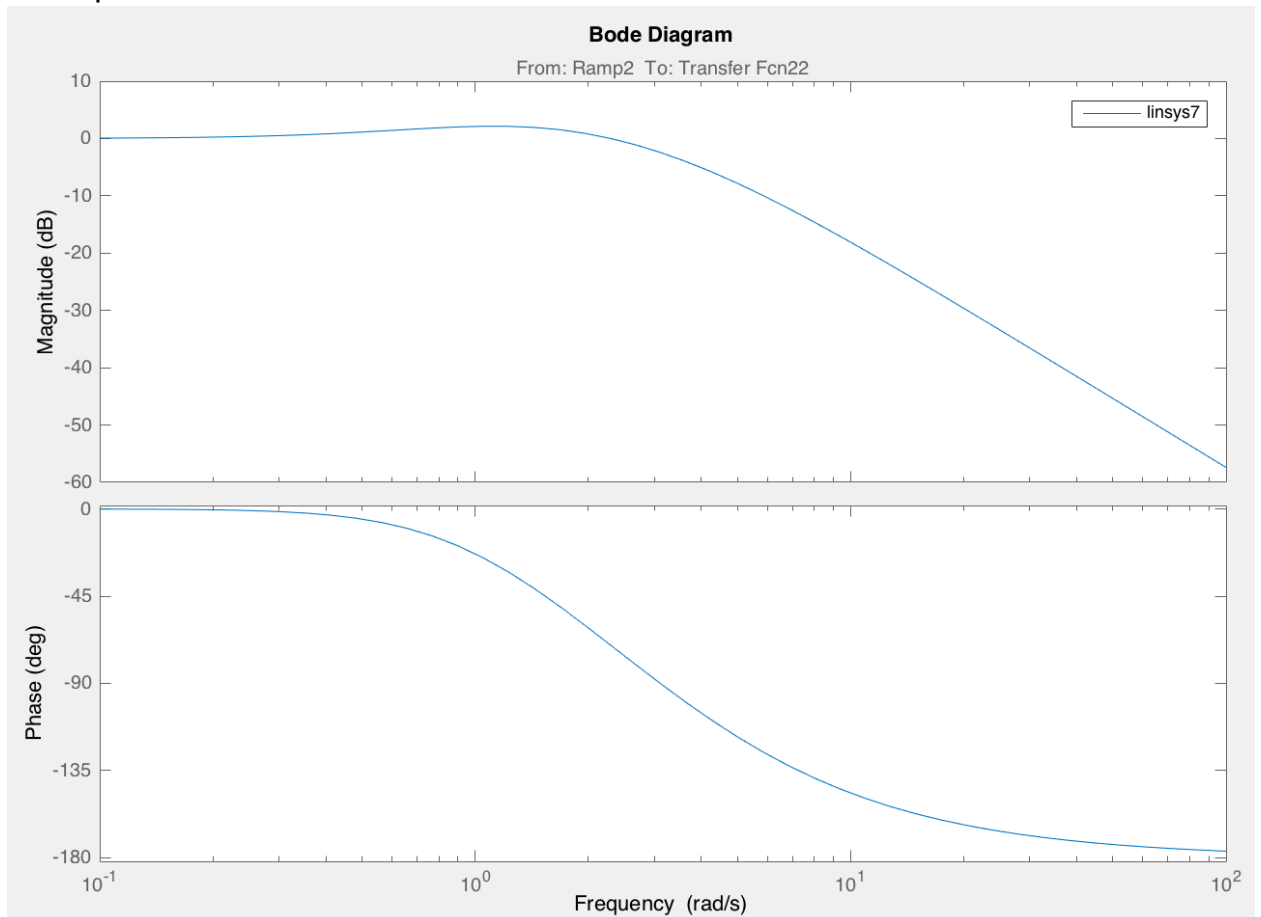
calculated result:

$$\varepsilon = 1 - C_0 g(t) = 1 - 1 * 1 = 0$$

3.b) $g(t) = t1(t)$



Bode plot:



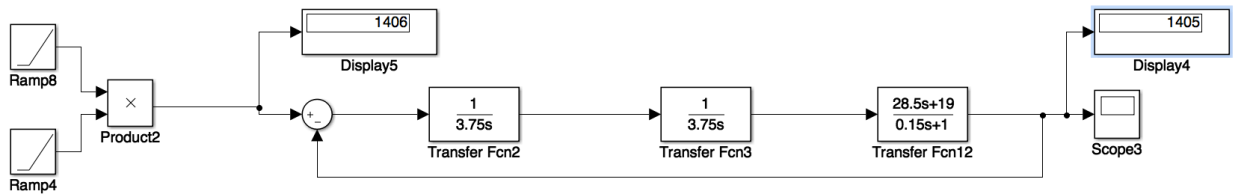
measured result:

$$\varepsilon = 37.5 - 37.5 = 0$$

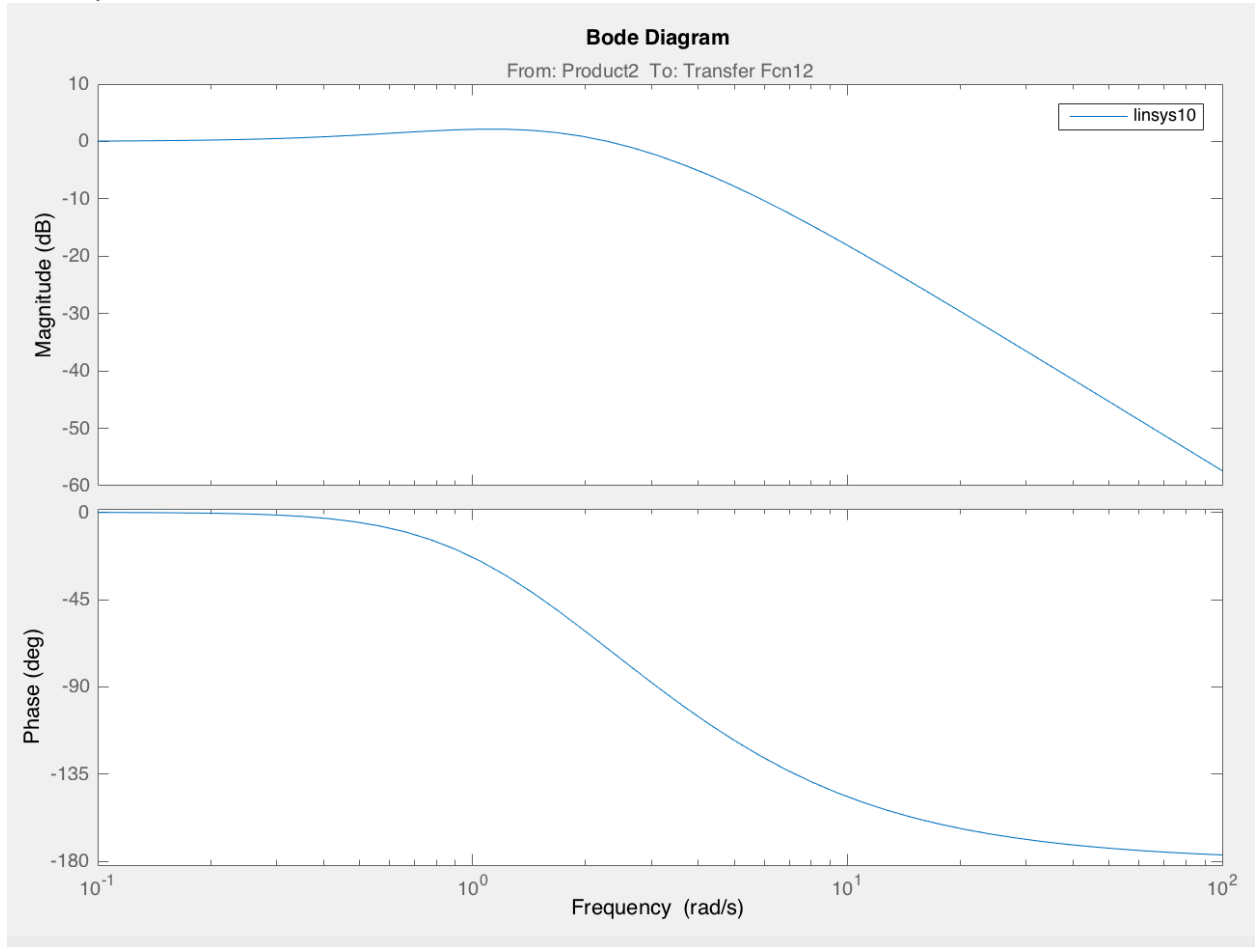
calculated result:

$$\varepsilon = 37.5 - C_0 g(t) - C_1 g'(t) = 37.5 - 1 \cdot 37.5 - 0 = 0$$

3.c) $g(t) = t^2 1(t)$



Bode plot :



measured result:

$$\varepsilon = 1406 - 1405 = 1$$

calculated result:

$$\varepsilon = 1406 - C_0 g(t) - C_1 g'(t) - C_2 g''(t)/2 = 1406 - 1 \cdot 1406 - 0 + 0.740132 = 0.740132$$

The results of measurements and calculations

Scheme	$X(t) = 1(t)$		$X(t) = t * 1(t)$		$X(t) = t^2 * 1(t)$	
	measured	calculated	measured	calculated	measured	calculated
static	0.05	0.05	2.17	2,167125	92	92,402765
Astatic 1st order	0	0	0.2	0	15	15,23733
Astatic 2nd order	0	0	0	0	1	0.740132