**Digital Control Architectures and Technologies (01PDCQW-01PDCOV)**

**Design Report**

***Plant discretization***

G(z) = 0.0014826 (z+0.9884) (z-0.9608)

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(z-1) (z^2 - 1.926z + 0.9277)

zero-pole-gain form

***Steady state requirements analysis***

L1 = 1, G(z)’s poles at one

Frome the first requirements, by looking into the tables we obtain that:

L = 2

L2 = 1 C(z)’s poles at 1

Preliminary form of C(Z)

C(z) = (S(z))/((z-1)\*(R’(z)))

***Transient requirements analysis***

zeta = 0.5594

wn = 54.8190

***Design settings***

The design is carried out by the cancellation of the plant’s zeros and poles within the cardioid defined by the damping coefficient zeta

Deg(A\_plus(z)) = 2

Deg(A\_minus(z)) = 0

Deg(B\_plus(z)) = 1

Deg(B\_minus(z)) = 1

Deg(S’(z)) = l + deg(A\_minus(z)) -1 = 2+0-1 =1

Deg(R’(z)) = deg(A’(Z)) – deg(B\_plus(z)) +l1 -1 = 2-1+1-1=1

Deg(Am(z)) = l+deg(A’(z))+deg(A\_minus(z))+l1-deg(B\_plus(z))-1=2+2-0+1-1-1=3 -> 3poles to place, two dominant poles according to the 2nd prototype model and one faster natural mode

Am(Z) = (z-p1)\*(z-p2)\*(z-p3) = Am’(z)\*Ao(z)

The new C(z) form is

C(z) = (B\_plus(z)\*S’(z))/(A\_minus(z)\*(z-1)\*R’(z))

***Controller design and performance evaluation***

The cascade controller is obtained through the solution of the diophantine equation:

(z-1)^l\*A\_minus(z)\*R’(z)+B\_minus(z)\*S’(z)) = Am(z)

C(z) = 225.24 (z-0.7413) (z^2 - 1.926z + 0.9277)

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(z-1) (z-0.9608) (z+0.1278)

zero-pole-gain form

F(z) = (A\_plus(z)\*(T’(z)))/(a\_pplus(z)\*S’(z))

F(z) Proper, so degT’(z)=deg(S’(z))=deg(Ao(z));

F(z) = 0.32995 (z-0.2158)

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(z-0.7413)

zero-pole-gain form

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| Requirement | 1 | 2 | 3 | 4 |
| Value | 0, verified | 0.8% | 0.12s | 35 |