1.- Programar la forma estándar, directa, serie y paralelo de la siguiente función de transferencia

$$G(z)=\frac{uz^{-3}+(2-u)z^{-2}+(u-3)z^{-1}+(1-\frac{u}{4})}{5uz^{-3}+(6-u)z^{-2}+(7-u)z^{-1}+(1-\frac{u}{8})}$$

u: último número del numero de cuenta del alumno

No.cta: 97145606
u=6

Solución:

$$G(z)=\frac{6z^{-3}+(2-6)z^{-2}+(6-3)z^{-1}+(1-\frac{6}{4})}{5(6)z^{-3}+(6-6)z^{-2}+(7-6)z^{-1}+(1-\frac{6}{8})}$$

$$G(z)=\frac{6z^{-3}-4z^{-2}+3z^{-1}+(\frac{4}{4}-\frac{6}{4})}{30z^{-3}+(0)z^{-2}+z^{-1}+(\frac{8}{8}-\frac{6}{8})}$$

$$G(z)=\frac{6z^{-3}-4z^{-2}+3z^{-1}+(\frac{-2}{4})}{30z^{-3}+(0)z^{-2}+z^{-1}+(\frac{2}{8})}$$

$$\boxed{G(z)=\frac{6z^{-3}-4z^{-2}+3z^{-1}-\frac{1}{2}}{30z^{-3}+z^{-1}+\frac{1}{4}}}\ \text{(simplificada)}$$

PROGRAMACIÒN FORMA DIRECTA

$$G(z)=\frac{Y(z)}{X(z)}=\frac{6z^{-3}-4z^{-2}+3z^{-1}-\frac{1}{2}}{30z^{-3}+z^{-1}+\frac{1}{4}}$$

$$\frac{Y(z)\left(30z^{-3}+z^{-1}+\frac{1}{4}\right)}{1}=\frac{X(z)\left(6z^{-3}-4z^{-2}+3z^{-1}-\frac{1}{2}\right.}{1}$$

$$Y(z)\left(30z^{-3}+z^{-1}+\frac{1}{4}\right)=X(z)\left(6z^{-3}-4z^{-2}+3z^{-1}-\frac{1}{2}\right)$$

$$30Y(z)z^{-3}+Y(z)z^{-1}+\frac{1}{4}Y(z)=$$

$$X(z)6z^{-3}-4X(z)z^{-2}+3X(z)z^{-1}-\frac{1}{2}$$

$$+\frac{1}{4}Y(z)=$$

$$X(z)6z^{-3}-4X(z)z^{-2}+3X(z)z^{-1}-\frac{1}{2}X(z)$$

$$-\left(30Y(z)z^{-3}+Y(z)z^{-1}\right)$$

$$Y(z)=4\begin{bmatrix}X(z)6z^{-3}-4X(z)z^{-2}+3X(z)z^{-1}-\frac{1}{2}X(z\\-\left(30Y(z)z^{-3}+Y(z)z^{-1}\right)\end{bmatrix}$$

$$Y(z)=4\begin{bmatrix}X(z)6z^{-3}-4X(z)z^{-2}+3X(z)z^{-1}-\frac{1}{2}X(z\\-\left(30Y(z)z^{-3}+Y(z)z^{-1}\right)\end{bmatrix}$$

$$\boxed{\begin{matrix}Y(z)=4X(z)6z^{-3}-16X(z)z^{-2}+12X(z)z^{-1}-2X(z)\\-120Y(z)z^{-3}-4Y(z)z^{-1}\end{matrix}}$$

DIAGRAMA DE BLOQUES PROGRAMACION DIRECTA

PROGRAMAR FORMA ESTANDAR

$$G(z)=\frac{Y(z)}{X(z)}=\frac{6z^{-3}-4z^{-2}+3z^{-1}-\frac{1}{2}}{30z^{-3}+z^{-1}+\frac{1}{4}}$$

$$G(z)=\frac{Y(z)}{X(z)}=\frac{6z^{-3}-4z^{-2}+3z^{-1}-\frac{1}{2}}{30z^{-3}+z^{-1}+\frac{1}{4}}$$

$$\frac{Y(z)}{X(z)}=\frac{Y(z)}{V(z)}\frac{V(z)}{X(z)}=\frac{6z^{-3}-4z^{-2}+3z^{-1}-\frac{1}{2}}{30z^{-3}+z^{-1}+\frac{1}{4}}$$

$$\frac{Y(z)}{V(z)}\frac{V(z)}{X(z)}=\left(\frac{6z^{-3}-4z^{-2}+3z^{-1}-\frac{1}{2}}{1}\right)\left(\frac{1}{30z^{-3}+z^{-1}+\frac{1}{4}}\right)$$

Donde:

$$\frac{Y(z)}{V(z)}=6z^{-3}-4z^{-2}+3z^{-1}-\frac{1}{2}$$

$$\frac{V(z)}{X(Z)}=\frac{1}{30z^{-3}+z^{-1}+\frac{1}{4}}$$

De aquí, hacemos un cambio de variable para Y(z) y X(z), (despeje)

$$Y(z)=V(z)\left(6z^{-3}-4z^{-2}+3z^{-1}-\frac{1}{2}\right)$$

$$\boxed{Y(z)=6V(z)z^{-3}-4V(z)z^{-2}+3V(z)z^{-1}-\frac{1}{2}V(z)}$$

$$V(z)\left(30z^{-3}+z^{-1}+\frac{1}{4}\right)=X(Z)$$

$$\left(30V(z)z^{-3}+V(z)z^{-1}+\frac{1}{4}V(z)\right)=X(Z)$$

$$\left(+\frac{1}{4}V(z)\right)=X(Z)-\left(30V(z)z^{-3}+V(z)z^{-1}\right)$$

$$\left(+\frac{1}{4}V(z)\right)=X(Z)-30V(z)z^{-3}-V(z)z^{-1}$$

$$V(z)=4\left[X(Z)-30V(z)z^{-3}-V(z)z^{-1}\right]$$

$$\boxed{V(z)=4X(Z)-120V(z)z^{-3}-4V(z)z^{-1}}$$

DIAGRAMA DE BLOQUES PROGRAMACION STANDAR

PROGRAMACIÒN FORMA SERIE O CASCADA

$$\boxed{H(z)=\prod_{k=1}^{K}H_k(Z)}$$

$$K = \frac{N+1}{2}$$

$$H_k(Z) = \frac{b_{k0} + b_{k1}z^{-1} + b_{k2}z^{-2} + b_{k3}z^{-3}}{1 + a_{k0} + a_{k1}z^{-1} + a_{k2}z^{-2} + a_{k3}z^{-3}}$$

Tenemos G(Z):

$$\boxed{G(z) = \frac{6z^{-3} - 4z^{-2} + 3z^{-1} - \frac{1}{2}}{30z^{-3} + z^{-1} + \frac{1}{4}}} \text{ (simplificada)}$$

Obteniendo polos y ceros de la función de transferencia:

$$G(z) = \frac{(z^{-1} - 0.205666)(z^{-1} - [0.2305 + j0.5933])(z^{-1} - [0.}{(z^{-1} + 0.1496)(z^{-1} - [0.07479 + j0.2239])(z^{-1} - [0.0}$$

Multiplicando y dividiendo por sus factores respectivos tenemos:

$$G(z) = \frac{(0.205666z^{-1} - 1)(z^{-1} - [0.2305 + j0.5933])(z^{-1} - [}{(z^{-1} + 0.1496)(z^{-1} - [0.07479 + j0.2239])(z^{-1} - [0.}$$

MEJOR:

$$G(z) = \frac{6 - 4z + 3z^2 - \frac{1}{2}z^3}{30 + z^2 + \frac{1}{4}z^3}$$

$$G(z) = \frac{-\frac{1}{2}z^3 + 3z^2 - 4z + 6}{\frac{1}{4}z^3 + z^2 + 30}$$

$$G(z) = \frac{(z - [0.5689 + j1.4644])(z - [0.5689 - j1.4644])(z -}{(z - [1.3425 + j4.0184])(z - [1.3425 + j4.0184])(z -}$$

Dividiendo entre Z

$$G(z) = \frac{(1 - [0.5689 + j1.4644]z^{-1})(1 - [0.5689 - j1.4644]}{(1 - [1.3425 + j4.0184]z^{-1})(1 - [1.3425 + j4.0184]}$$

Y un posible empaquetamiento de los polos y ceros sería:

$$(1 - 0.5689z^{-1} - j1.4644z^{-1})$$
$$(1 - 0.5689z^{-1} + j1.4644z^{-1})$$

$$1 - 0.5689z^{-1} - j1.4644z^{-1} - 0.5689z^{-1} + (0.5689)^2 z^{-2} + (0.5689z^{-1})(j1.4644z^{-1}) + j1.4644z^{-1} - (0.5689z^{-1})(j1.4644z^{-1}) - (j1.4644z^{-1})^2$$

$$1 - 0.5689z^{-1} - 0.5689z^{-1} + (0.5689)^2 z^{-2} - (j1.4644z^{-1})^2$$

$$1 - 2(0.5689z^{-1}) + (0.5689)^2 z^{-2} + 2.1445z^{-2}$$

$$1 - 1.1378z^{-1} + 2.4681z^{-2}$$

$$G(z) = \frac{(1 - [0.5689 + j1.4644]z^{-1})(1 - [0.5689 - j1.4644]z^{-1})(}{(1 - [1.3425 + j4.0184]z^{-1})(1 - [1.3425 + j4.0184]z^{-1})(}$$

$$(1 - 1.3425z^{-1} - j4.0184z^{-1})$$
$$(1 - 1.3425z^{-1} + j4.0184z^{-1})$$

$$1 - 1.3425z^{-1} - 1.3425z^{-1} + (1.3425)^2 z^{-2} - (j4.0184z^{-1})^2$$

$$1 - 2.685z^{-1}$$
$$+ 1.8023z^{-2}$$
$$+ (16.1475z^{-2})$$

$$1 - 2.685z^{-1} + 17.9498z^{-2}$$

$$1 - 1.1378z^{-1} + 2.4681z^{-2}$$

$$G(z) = \frac{(1 - 1.1378z^{-1} + 2.4681z^{-2})(1 - 4.8622z^{-1})}{(1 - 2.685z^{-1} + 17.9498z^{-2})(1 + 6.6851z^{-1})}$$

$$G_1(z) = \frac{(1 - 1.1378z^{-1} + 2.4681z^{-2})}{(1 - 2.685z^{-1} + 17.9498z^{-2})}$$
$$G_2(z) = \frac{(1 - 4.8622z^{-1})}{(1 + 6.6851z^{-1})}$$

$$G(z) = G_1(z)G_2(z)$$

DIAGRAMA DE BLOQUES
PROGRAMACION STANDAR

PROGRAMACIÒN FORMA PARALELO

$$G(z) = G_1(z) + G_2(z) + G_3(z) + \bullet\bullet\bullet$$

$$\boxed{G(z) = \frac{(1 - 1.1378z^{-1} + 2.4681z^{-2})(1 - 4.8622z^{-1})}{(1 - 2.685z^{-1} + 17.9498z^{-2})(1 + 6.6851z^{-1})}}$$

$$G(z) = \frac{(z^2 - 1.1378z + 2.4681)(z - 4.8622)}{(z^2 - 2.685z + 17.9498)(z + 6.6851)}$$

$$\frac{(z^2 - 1.1378z + 2.4681)(z - 4.8622)}{(z + 6.6851)(z^2 - 2.685z + 17.9498)} = \frac{A}{(z + 6.6851)} + \frac{Bz + C}{(z^2 - 2.685z + 17.9498)}$$

Multiplicando por el minimo comùn multiplo:

$$(z^2 - 1.1378z + 2.4681)(z - 4.8622) = A(z^2 - 2.685z + 17.9498) + (Bz + C)(z + 6.6851)$$

$$(z^3 - 6z^2 + 8z - 12) = A(z^2 - 2.685z + 17.9498) + (Bz + C)(z + 6.6851)$$

$$(z^3 - 6z^2 + 8z - 12) = Az^2 - 2.685Az + 17.9498A + (Bz + C)(z + 6.6851)$$

$$(z^3 - 6z^2 + 8z - 12) = Az^2 - 2.685Az + 17.9498A + Bz^2 + 6.6851Bz + Cz + 6$$

$$(z^3 - 6z^2 + 8z - 12) = Az^2 + Bz^2 + 6.6851Bz + Cz - 2.685Az + 17.9498A + 6$$

$$(z^3 - 6z^2 + 8z - 12) = (A + B)z^2 + (6.6851B + C - 2.685A)z + (17.9498A +$$

igualando terminos:

$$1 = 0 \_\_\_\_\_ ERROR$$

$$(A + B) = -6$$

$$(6.6851B + C - 2.685A) = 8$$

$$(17.9498A + 6.6851C) = -12$$

A=-4.1398
B=-1.8602
C=9.3204

$$G(z) = \frac{-4.1398}{(z + 6.6851)} + \frac{-1.8602z + 9.3204}{(z^2 - 2.685z + 17.9498)}$$

2.- Determinar la estabilidad de G(z) por la prueba de Jury

$$G(z) = \frac{6z^{-3} - 4z^{-2} + 3z^{-1} - \frac{1}{2}}{30z^{-3} + z^{-1} + \frac{1}{4}}$$

$$D(z) = 30z^{-3} + z^{-1} + \frac{1}{4}$$

$$D(z) = 30 + z^{2} + \frac{1}{4}z^{3}$$

Renglón	Z^0	z	Z^2	z^3
1	30	0	1	0.25
2	0.25	1	0	30
3	899.9375	-0.25	30	