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

EQUIPO 2
u=2

Solución:

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

$$G(z)=\frac{2z^{-3}-1z^{-1}+(\frac{4}{4}-\frac{2}{4})}{10z^{-3}+(4)z^{-2}+5z^{-1}+(\frac{8}{8}-\frac{2}{8})}$$

$$G(z)=\frac{2z^{-3}-z^{-1}+(\frac{2}{4})}{10z^{-3}+4z^{-2}+5z^{-1}+(\frac{6}{8})}$$

$$\boxed{G(z)=\frac{2z^{-3}-z^{-1}+\frac{1}{2}}{10z^{-3}+4z^{-2}+5z^{-1}+\frac{3}{4}}}\ \text{(simplificada)}$$

PROGRAMACIÒN FORMA DIRECTA

$$G(z)=\frac{Y(z)}{X(z)}=\frac{2z^{-3}-z^{-1}+\frac{1}{2}}{10z^{-3}+4z^{-2}+5z^{-1}+\frac{3}{4}}$$

$$G(z)=\frac{Y(z)}{X(z)}=\frac{2z^{-3}-z^{-1}+\frac{1}{2}}{10z^{-3}+4z^{-2}+5z^{-1}+\frac{3}{4}}$$

$$\frac{Y(z)\left(10z^{-3}+4z^{-2}+5z^{-1}+\frac{3}{4}\right)}{1}=\frac{X(z)\left(2z^{-3}-z^{-1}+\frac{1}{2}\right)}{1}$$

$$Y(z)\left(10z^{-3}+4z^{-2}+5z^{-1}+\frac{3}{4}\right)=X(z)\left(2z^{-3}-z^{-1}+\frac{1}{2}\right)$$

$$10Y(z)z^{-3}+4Y(z)z^{-2}+5Y(z)z^{-1}+\frac{3}{4}Y(z)=$$
$$2X(z)z^{-3}-X(z)z^{-1}+\frac{1}{2}X(z)$$

$$+\frac{3}{4}Y(z)=$$
$$2X(z)z^{-3}-X(z)z^{-1}+\frac{1}{2}X(z)-\left(10Y(z)z^{-3}+4Y(z)z^{-2}+\right.$$

$$+Y(z)=$$
$$\frac{4}{3}\left[2X(z)z^{-3}-X(z)z^{-1}+\frac{1}{2}X(z)-\left(10Y(z)z^{-3}+4Y(z)z^{-2}\right.\right.$$

$$+Y(z)=$$
$$\frac{4}{3}\left[2X(z)z^{-3}-X(z)z^{-1}+\frac{1}{2}X(z)-10Y(z)z^{-3}-4Y(z)z^{-2}\right.$$

$$Y(z)=$$
$$\frac{8}{3}X(z)z^{-3}-\frac{4}{3}X(z)z^{-1}+\frac{4}{6}X(z)-\frac{40}{3}Y(z)z^{-3}-\frac{16}{3}Y(z)z$$

$$Y(z)=$$
$$\frac{8}{3}X(z)z^{-3}-\frac{4}{3}X(z)z^{-1}+\frac{2}{3}X(z)-\frac{40}{3}Y(z)z^{-3}-\frac{16}{3}Y(z)z$$

DIAGRAMA DE BLOQUES
PROGRAMACION DIRECTA

PROGRAMAR FORMA ESTANDAR

$$\boxed{G(z) = \frac{2z^{-3} - z^{-1} + \frac{1}{2}}{10z^{-3} + 4z^{-2} + 5z^{-1} + \frac{3}{4}}} \text{ (simplificada)}$$

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

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

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

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):

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

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

MEJOR:

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

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

$$G(z) = \frac{(z - [0.5689 + j1.4644])(z - [0.5689 - j1.4644])(z - 4.86}{(z - [1.3425 + j4.0184])(z - [1.3425 + j4.0184])(z + 6.68}$$

Dividiendo entre Z

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

Y un posible empaquetamiento de los polos y ceros sería:

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

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

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

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

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

$G(z) =$

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

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

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

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

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

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

$G(z) =$

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

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

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

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	