ejemplo

Method Zieggler – Nichols (closed loop TF)

1. Apply the Routh - Hurwitz criterion
2. the Zieggler – Nichols criterion needs that the system has a pair of complex poles in the imaginary axis.

$$\frac{Y(s)}{R(s)} = \frac{K}{s^4 + 7s^3 + 15s^2 + 25s + K}$$

Obtain the P.I.D controller parameters by Zeigler-Nichols method.

4	1	15	K
3	7	25	
2	b_{n-1}	b_{n-3}	
1	c_{n-1}		
ϕ	d_{n-1}		

$$b_{n-1} = -\frac{(1.25 - 7.15)}{7} = 11,43$$

$$b_{n-3} = -\frac{(1.\phi - 7.K)}{7} = K$$

$$c_{n-1} = -\frac{(7.K - 11,43.25)}{11,43} = 25 - 0,61K$$

$$d_{n-1} = -\frac{(11,43.\phi - (25 - 0,61K).K}{(25 - 0,61K)}$$

$$= K$$

Special case 1:

If a first column term in any Row is zero, but the remaining terms are not zero or there is no remaining term. the zero is replaced by a very small positive term ε. And If the sign of the coefficient above ε is the same as that below, it indicates that there are a pair of imaginary roots.

$\boxed{c_{n-1} = 0}$ $\quad 25 - 0,61K = \phi \Rightarrow K = 40,8$

$$* \quad 11,43 s^2 + 40,8 = \phi$$

$$11,43 s^2 = -40,8$$

$$s^2 = -3,56$$

$$s = \pm \sqrt{-3,56} = \pm j\sqrt{3,56} \cong \pm 1,89j$$