

GATE - BM 22

EE23BTECH11215 - Penmetsa Srikar Varma

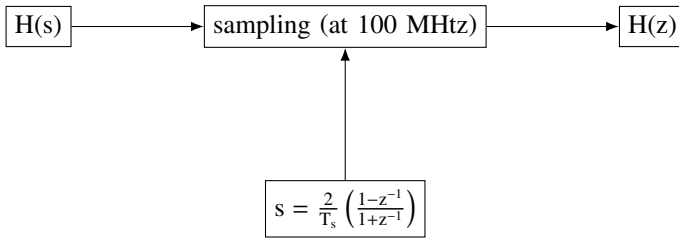
QUESTION

A continuous time transfer function, $H(s) = \frac{1 + \frac{s}{10^6}}{s}$ is converted to a discrete time transfer function, $H(z)$ using a bi-linear transformation at 100 MHz sampling rate. The pole of $H(z)$ is located at $z = ?$

SOLUTION

Variable	Condition
$F_s = 100 \text{ MHz}$	sampling rate
$T_s = \frac{1}{F_s}$	sampling period
s_0	pole of $H(z)$

Table of Parameters



From above,

$$H(z) = H\left(2F_s \left(\frac{1 - z^{-1}}{1 + z^{-1}}\right)\right) \quad (1)$$

So, from (1)

$$H(z) = \frac{1 + \frac{2F_s}{10^6} \left(\frac{1 - z^{-1}}{1 + z^{-1}}\right)}{2F_s \left(\frac{1 - z^{-1}}{1 + z^{-1}}\right)} \quad (2)$$

$$H(z) = \frac{1}{200 \times 10^6} \left(\frac{1 + z^{-1} + 200(1 - z^{-1})}{1 - z^{-1}} \right) \quad (3)$$

$$H(z) = 5 \times 10^{-9} \left(\frac{201 - 199z^{-1}}{1 - z^{-1}} \right) \quad (4)$$

So, s_0 is at $z=1$