Madan Mohan Malaviya University Of Technology, Gorakhpur

Electronics and Communication Engineering Department

DIGITAL SIGNAL PROCESSING (BEC-42)

ASSIGNMENT - II

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1. Obtain the mapping formula for the approximation of derivatives method using backward difference. Also discuss the limitation of approximation of derivatives method.

2. Obtain the mapping formula for the impulse invariant transformation. Also discuss the disadvantages of impulse invariant transformation.

3. Obtain the transformation formula for the bilinear transformation. Further, discuss the advantages and disadvantages of biliniear transformation method.

4. Use the backward difference for the derivative to convert the following analog filter with system function

   (a) $H(s) = \frac{1}{s+5}$ (b) $H(s) = \frac{1}{s^2+4}$ (c) $H(s) = \frac{1}{(s+0.2)^2+16}$

5. For the analog transfer function

$$H(S) = \frac{1}{(s+2)(s+5)}$$

   determine $H(z)$ using impulse invariant technique. Assume $T = 1s$.

6. Apply bilinear transformation to

$$H(S) = \frac{2}{(s+1)(s+3)}$$

   with $T = 0.1s$

7. A digital filter with a $3dB$ bandwidth of 0.25π is to be designed from the analog filter whose system response is

$$H(S) = \frac{\Omega_c}{s+\Omega_c}$$

   Use bilinear transformation and obtain $H(z)$.

8. Design a digital Butterworth filter that satisfies the following constraint using bilinear transformation. Assume $T = 1s$.

$$\begin{aligned} 0.9 \leq |H(e^{j\omega})| \leq 1 \qquad & 0 \leq \omega \leq \pi/2 \\ |H(e^{j\omega})| \leq 0.2 \qquad & 3\pi/4 \leq \omega \leq \pi \end{aligned}$$

9. Design a Chebyshev filter with a maximum passband attenuation of 2.5 dB at $\Omega_p = 20$ rad/sec and the stopband attenuation of 30 sdB at $\Omega_s = 80$ rad/sec.