Homework 8

Submission Deadline: May 05, 2017 11:59 PM

Instructions:

- **i) Submit on Blackboard before the mentioned deadline.**
- **ii) No collaboration is allowed for any problems.**
- **iii) The points allotted for each problem is noted alongside.**
- **iv) This homework is optional and extra credit, and will be added your homework score. Partial credit is available.**
- **v) No late submissions will be accepted.**

1. Derive the transfer function for the continuous time third order normalized Butterworth filter. You can use MATLAB for it, or derive the poles and calculate it. (5 points)

   Approximate this continuous time filter with a digital filter using

a) Impulse Invariance Method
b) Step Invariance Method
c) Finite Difference Design-Backward Difference
d) Finite Difference Design-Forward Difference
e) Bilinear Method
f) Matched Z-transform
g) Direct Substitution

Use $f_s = 1000$ samples per second.

Find the transfer function, poles and zeros of each digital filter, and plot the frequency response over the range $-2\pi < \Omega < 2\pi$.

(7X5=35 points)

MATLAB Problem

2. Using MATLAB codes, obtain the transfer function of
   a) A seventh order normalized low pass elliptic filter

b) A eighth order normalized low pass Chebyshev Type 1

Plot the frequency response of the analog filters of 2(a) and 2(b). (10 points)

Approximate these analog filter using impulse invariance method using MATLAB's function. Use $f_s = 1000$ samples per second.

Find its transfer function, zeros and poles, and frequency response over the range $-2\pi < \Omega < 2\pi$.

(10 points)