SE Course: Digital Filter Design

MM2: Synthesis of Discrete-Time IIR filters

1 Reading

Page 160-163, 439-458 and 824-829 of Alan V. Oppenheim, Ronald W. Schafer, and John R. Buck: "*Discrete-Time Signal Processing (Second Edition)*", Prentice Hall, 1999.

2 Content

- Continuous time filters
- Impulse-invariance method
- Bilinear transformation method

3 Exercise

1. Calculate the *DC-gain* (the system magnitude when frequency is 0) and the *cutoff frequency* (the frequency point with 3dB-decreasing of the DC-gain) of the analog lowpass filter which we already analyzed in exercise one, i.e.,
$$H(s) = 1/(1 + RCs)$$
2. Calculate the *DC-gain* and the *cutoff frequency* of the obtained discrete-time lowpass filter which we already analyzed in exercise one, i.e.,
$$H(e^{j\omega}) = 0.125/(1 - 0.8825e^{-j\omega})$$
3. Design a lowpass DT filter using the impulse-invariance method, such that
   - maximal flat character in passband;
   - DC gain: 0 dB
   - Gain at 750Hz: minimum -1.0dB
   - Gain at 1500Hz: maximum -10.0dB
   - Sampling frequency: 8000Hz
4. Design a lowpass DT filter using the bilinear transformation, which has the same specifications as above exercise.
5. Begin to be familiar with Filter Design and Analysis Tool in Matlab
   Open Matlab, then type
   $\gg$ fdatool