

# PE Course: Digital Filter Design

## Frequency Transformation of LP-IIR Filters and Linear phase systems

### 1 Reading

The distributed document and Page 291-311 of Alan V. Oppenheim, Ronald W. Schaffer, and John R. Buck: "Discrete-Time Signal Processing (Second Edition)", Prentice Hall, 1999.

### 2 Content

- Explanation of Exercise Two
- Frequency transformations
- Linear phase systems

### 3 Exercise

1. Use the discrete-time lowpass filter which we already got in exercise one and two as a prototype lowpass filter, i.e., there is

$$H_{lp}(e^{j\omega}) = 0.125/(1 - 0.8825e^{-j\omega})$$

- (a) Find out the cutoff frequency  $\theta_c$  of this prototype filter (see exercise two);
  - (b) Design a highpass filter using the frequency transformation, where the cutoff frequency for the desired highpass filter is  $\omega_c = 3\pi/4$  rad/sample;
  - (c) Draw out bode plots of both filters using Matlab function **freqz([num],[den])** and check whether this design reaches the requirement or not.
2. Exercise 5.40 on page 325 of textbook.
  3. Exercise 5.41 on page 326 of textbook.