SE Course: Digital Filter Design

MM1: Introduction to Digital Filter Techniques

1 Reading

Page 16-40 and 240-270 of Alan V. Oppenheim, Ronald W. Schafer, and John R. Buck: "*Discrete-Time Signal Processing (Second Edition)*", Prentice Hall, 1999.

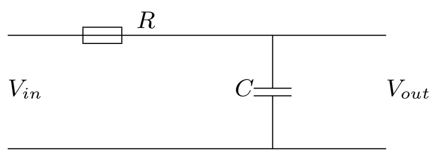
2 Content

- Filtering examples
- Review of discrete-time processes and systems
- Frequency responses of LTI systems

3 Exercise

1. Write down the methods you thought about so as to deal with noises within the cockpit.

2. Determine the types (IIR or FIR) of following systems and explain the reason.
   - $h[n] = u[n] - u[n-3]$
   - $h[n] = \begin{cases} ln(n+1) & \text{for } n \geq 0 \\ 0 & \text{for } n < 0 \end{cases}$
   - $H(z) = 1 + z^2 - z^{-4}$
   - $H(e^{j\omega}) = \frac{1}{1-2e^{-j\omega}}$
3. Consider the following analog circuit, where resistance $R = 1k\Omega$ and capacitor $C = 1\mu F$.



   - Calculate the *impulse response function* $h(t)$ of above system by regarding voltage V_{in} as the input and V_{out} as the output.
   - Calculate an *impulse response sequence* $h[n]$ by following the formula: $h[n] = T_d h(nT_d)$, where $h(t)$ is the obtained function in the above exercise and $T_d = 8000$.
   - Obtain the system function $H(z)$ and frequency response $H(e^{j\omega})$ of above sequence $h[n]$.
   - Is the system $H(z)$ stable? and why?
   - Is this analog circuit acting as a low-pass or high-pass filter?
4. Begin to be familiar with Matlab. Download file **IIR.m** from the course webpage and run it.