Preparation:

1. Study the following matlab functions. conv, filter, filtic, impz,

2. Evaluate the following discrete-time convolution sums.
   
   a) \( y[n] = u[n+3] \ast u[n-3] \)
   
   b) \( y[n] = \frac{1}{4} u[n] \ast u[n+2] \)
   
   c) \( y[n] = x[n] \ast h[n], \quad x[n] = \delta[n] - 2\delta[n-1] + \delta[n+2] \)
   
   \( h[n] = u[n] - u[n-3] \)
   
   d) \( y(t) = [u(t) - u(t-2)] \ast u(t) \)

3. Two systems have impulse responses

   \[
   h_1[n] = \begin{cases} 
   \frac{1}{4}, & 0 \leq n \leq 3 \\
   0, & \text{otherwise}
   \end{cases}
   \]
   
   and
   
   \[
   h_2[n] = \begin{cases} 
   \frac{1}{4}, & n = 0, 2 \\
   -\frac{1}{4}, & n = 1, 3 \\
   0, & \text{otherwise}
   \end{cases}
   \]

   Evaluate the step responses of the above linear and time invariant systems. Evaluate the outputs of the systems for the following inputs

   a) \( x[n] = r[n] \)
   
   b) \( x[n] = u[n] - u[n-10] \)
   
   c) \( x[n] = u[n+10] - u[n-5] \)
   
   d) \( x[n] = \delta[n-5] + \delta[n-10] + u[n-15] \)

Experiment:

Find the output signals in preparation part 2 and 3 using matlab conv function and plot them using matlab. Compare the matlab outputs with your hand results.

Report:

Explain the convolution concept, what do you understand with the ‘convolution’ word. Can you explain it to a non-technical student?

Good Luck

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