EE3210 Signals and Systems

Tutorial 5

Problem 1: One of the important properties of convolution sum is the associative property, i.e.,

$$x[n] * (h_1[n] * h_2[n]) = (x[n] * h_1[n]) * h_2[n]. \tag{1}$$

Prove the equality by showing that both sides of (1) equal

$$\sum_{r=-\infty}^{+\infty} \sum_{m=-\infty}^{+\infty} x[r]h_1[m]h_2[n-r-m].$$

Problem 2: Consider a discrete-time LTI system with unit impulse response $h[n] = 4^n u[2-n]$. Use the convolution sum to find the response $y[n]$ of the system to the input $x[n] = (-\frac{1}{2})^n u[n-4]$.

Problem 3: Consider a continuous-time LTI system with unit impulse response $h(t) = e^{2t}u(1-t)$. Use the convolution integral to find the response $y(t)$ of the system to the input $x(t) = u(t) - 2u(t-2) + u(t-5)$.