Lecture S6 Muddiest Points

General Comments

Not many cards today, probably because folks were delayed to class by the quiz.

Responses to Muddiest-Part-of-the-Lecture Cards

(18 cards)

1. ***What is the physical significance of convolution? (1 student)*** The convolution integral is a consequence of linearity and time-invariance, so in a sense all the physics is based in the analysis that leads on to conclude that a system is LTI — everything else is a mathematical consequence of that. However, you can also understand the convolution integral as summing up lots of delayed impulse responses, which is a result of the LTI assumption, and representing $u(t)$ as a sum of delayed impulses.

2. ***So if there is a "West Coast" school of thought that block diagrams should be drawn right to left, don't these folks write text books? (1)*** Actually, they do, though most are graduate texts.

3. ***In the 3rd PRS question, why can we assume that $f(t) * g(t)$ in the boxed region? That is, how do we know that the output of the G block is $g(t)$? (1)*** The output of G is *not* $g(t)$, since the input to G is $h(t)$, not $\delta(t)$. The point is that the *impulse response* of the boxed region is $f(t) * g(t)$. Since the input to the boxed region is $h(t)$, the output of the boxed region is $[f(t) * g(t)] * h(t)$.

4. ***In your derivation of the convolution of a signal with an impulse, you had***

$$\begin{aligned} f(t) * \delta(t) &= \int_{-\infty}^{\infty} f(t-\tau)\delta(\tau)\,d\tau \\ &= \int_{-\infty}^{\infty} f(t)\delta(\tau)\,d\tau \end{aligned}$$

   How did you do the last step? (1) Since $\delta(t) = 0$ for all $t \neq 0$, we only have to know the value of $f(t-\tau)$ when $\tau = 0$, which is $f(t)$.

5. ***Please explain the sifting property again. (2)*** See answer above. The sifting property just says that

$$\int_{-\infty}^{\infty} f(t)\delta(t-T)\,d\tau = f(T)$$

   Since $\delta(t-T) = 0$ for all $t \neq T$, we only have to know the value of $f(t)$ when $t = T$, which is $f(T)$. Then the integral becomes

$$\int_{-\infty}^{\infty} f(t)\delta(t-T)\,d\tau = \int_{-\infty}^{\infty} f(T)\delta(t-T)\,d\tau = f(T)\int_{-\infty}^{\infty} \delta(t-T)\,d\tau = f(T)$$

6. ***So in general, the convolution integral says that***

$$\textit{output} = \textit{impulse response} * \textit{input}$$

   Is that correct? (1) Yes, always for an LTI system.

7. ***No mud. (11)*** Good. Comments from students: ***"Class is too early."*** Really? Class today wasn't until 10:00 am. Most people have been at work 2 hours by then. ***"PRS is really helping me understand the material."*** Good! ***"Overall, lecture was too slow today."*** Perhaps. It wasn't helped by the delay due to the quiz.