ECE 3500: Fundamentals of Signals and Systems

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Convolution Handout

1. $f(t) * g(t) = \displaystyle\int_{-\infty}^{\infty} f(\tau)g(t-\tau)d\tau$

2. $f(t) * g(t) = g(t) * f(t)$

3. $f(t) * \delta(t) = f(t)$

4. $f(t) * \delta(t-\tau) = f(t-\tau)$

5. $\displaystyle\int_{-\infty}^{\infty} u(\tau)f(\tau)u(t-\tau)g(t-\tau)d\tau = u(t)\int_{0}^{t} f(\tau)g(t-\tau)d\tau$

6. $\displaystyle\int_{-\infty}^{\infty} u(\tau)f(\tau)u(t-\tau)d\tau = u(t)\int_{0}^{t} f(\tau)d\tau$

7. $\displaystyle\int_{-\infty}^{\infty} u(\tau)e^{s_1\tau}u(t-\tau)d\tau = \frac{u(t)}{s_1}(e^{s_1 t} - 1)$

8. $\displaystyle\int_{-\infty}^{\infty} u(\tau)e^{s_1\tau}u(t-\tau)e^{s_2(t-\tau)}d\tau = \frac{u(t)}{s_1 - s_2}(e^{s_1 t} - e^{s_2 t}), \quad s_1 \neq s_2$

9. $\displaystyle\int_{-\infty}^{\infty} u(\tau)e^{s_1\tau}u(t-\tau)e^{s_1(t-\tau)}d\tau = u(t)te^{s_1 t}$

10. $\displaystyle\int_{-\infty}^{\infty} u(\tau)\tau^n e^{s_1\tau}u(t-\tau)e^{s_1(t-\tau)}d\tau = u(t)\frac{t^{n+1}}{n+1}e^{s_1 t}, \quad n \geq 0$