18.034, Honors Differential Equations
Prof. Jason Starr
Lecture 21: Brief Version
3/29/04

10 min's

Convolution: (i) $f * g = g * f$, (ii) $(f * g) * h = f * (g * h)$,
(iii) $(f_1 + f_2) * g = f_1 * g + f_2 * g$, $(c \bullet f) * g = c \bullet (f * g)$,
(iv) $\frac{d}{dt}(f * g) = f * \left(\frac{dg}{dt}\right)$.

Periodic version of convolution

10 min's

Quick review of F exp. Series: Use to solve driven ODE's

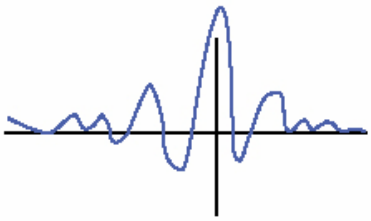
$a_n(f * g) = \sqrt{2L}\, a_n(f) \bullet a_n(g)$, $a_n(f \bullet g) = \frac{1}{\sqrt{2L}} \sum_{m=-\infty}^{\infty} a_m(f) a_{n \bullet m}(g)$

Truncated Fourier series $\sum_{m=-N}^{N} a_n(f)\Phi_n(x) = (f * D_n)(x)$

$D_n(u) = \frac{1}{2L} \sum_{n=-N}^{N} e^{\frac{in\pi}{L} \bullet U}$

$\int_{-\infty}^{\infty} D_n(u) = 1$. $\lim D_n(u) = 0$

$C_0^\infty(\mathbb{R})$



10 min's

Dir delta fnc'n: $I_f(g) = \int_{-\infty}^{\infty} f(y)g(y)dy$.

I: PC $\to$ linear mps $C_0^\infty(\mathbb{R}) \to \mathbb{R}$
$I_{\mathbb{R}}(g) := g(0)$.

15 min's

For any function f, $f = f * \delta = \delta * f$.

Using R to find sol'n of $I_y = f$.