

Part II Problems

Problem 1: [Convolution]

(a) Let $q(t) = \cos(\omega t)$. Compute $w(t) * q(t)$ (where $w(t)$ is the unit impulse response for $D + kI$) and verify that it is the solution to $\dot{x} + kx = q(t)$ with rest initial conditions.

(b) Let $q(t) = 1$. Compute $w(t) * q(t)$ (where $w(t)$ is the unit impulse response for $D^2 + \omega_0^2 I$) and verify that it is the solution to $\ddot{x} + \omega_0^2 x = q(t)$ with rest initial conditions.

(c) Compute $t^2 * t$ and $t * t^2$. Are they equal?

(d) Compute $(t * t) * t$ and $t * (t * t)$. Are they equal?

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