✓testing Exam 1, 2004

1) $$\frac{X(j\omega)}{F(j\omega)} = \frac{1}{-10\omega^2 + .01j\omega + 1000}$$

2) $$f(t) = \sum_{-\infty}^{\infty} F_n e^{j2\pi nt/T}$$

$T = 3$

$$F_n = \frac{1}{3}\int_2^3 e^{-\frac{2\pi n j}{3}t}\, dt$$

$$= \frac{1}{3}\,\frac{-3}{2\pi n j}\, e^{-\frac{2\pi n j t}{3}}\Big|_2^3$$

$$= \frac{-1}{2\pi n j}\left(e^{-2\pi n j} - e^{-\frac{j4\pi n}{3}}\right)$$

$$= \frac{-1}{2\pi n j}\left(1 - e^{-j\frac{4\pi n}{3}}\right)$$

$$F_0 = \frac{1}{3}\int_2^3 1\, dt = \frac{1}{3}$$

$$f(t) = \frac{1}{3} + \sum_{\substack{n=-\infty \\ n\neq 0}}^{\infty} \frac{-\left(1 - e^{-j\frac{4\pi n}{3}}\right)}{2\pi n j}\, e^{j2\pi nt/3}$$ ✓

$$= \frac{1}{3} + \frac{-1}{2\pi j}\sum_{n=1}^{\infty}\frac{1}{n}\left(e^{j\frac{2\pi nt}{3}} - e^{-j\frac{2\pi nt}{3}}\right)$$

$$+ \frac{+1}{2\pi j}\sum_{n=1}^{\infty}\frac{1}{n}\left(e^{j\frac{2\pi n}{3}(2+t)} - e^{-j\frac{2\pi n}{3}(2+t)}\right)$$

$$= \frac{1}{3} + \frac{-1}{2\pi j}\sum_{n=1}^{\infty}\frac{1}{n}2j\sin\frac{2\pi nt}{3}$$

$$+ \frac{1}{2\pi j}\sum_{n=1}^{\infty}\frac{1}{n}2j\sin\left(\frac{2\pi n}{3}(2+t)\right)$$

$$= \frac{1}{3} + \sum_{n=1}^{\infty}\frac{1}{n\pi}\left[\sin\left(\frac{2\pi n}{3}(2+t)\right) - \sin\frac{2\pi n}{3}\right]$$

3) $\Psi_1 = \frac{1}{\sqrt{.0841}} \begin{bmatrix} .08450 \\ .00357 \\ .27811 \end{bmatrix}$ (not mass normalized without $\frac{1}{\sqrt{}}$)

4) No. There is no information in that matrix.

5) $H(j\omega) = \frac{.35282}{1.58 - \omega^2} + \frac{-.3333}{4 - \omega^2} + \frac{-.01978}{11.42 - \omega^2}$

6) $z(t) = S(t)\, z(0) = \begin{bmatrix} \frac{\sin \omega_n t}{\omega_n} \\ \cos \omega_n t \end{bmatrix}$

$x(t) = \frac{\sin \omega_n t}{\omega_n}$

$\dot{x}(t) = \cos \omega_n t$