영상레이더간섭기법 중간시험

2006년 10월 18일(수) 3-6시. 강원대학교 지구물리학과 이훈열 교수

1. Write down the Fourier integral of $h(t)$ to give $H(f)$ by the definition given in the lecture.
2. Prove that the inverse Fourier integral of $H(f)$ results in $h(t)$.
3. Prove the following Fourier transform pairs.

$$h(t) = \begin{cases} A & |t| < T_0 \\ \dfrac{A}{2} & t = \pm T_0 \\ 0 & |t| > T_0 \end{cases} \quad \Leftrightarrow \quad H(f) = 2AT_0 \frac{\sin(2\pi T_0 f)}{2\pi T_0 f}$$

4. Using the definition of impulse function $\int_{-\infty}^{\infty} \delta(t-t_0)x(t)dt = x(t_0)$, prove $\delta(t) \Leftrightarrow 1$.
5. Prove $A\cos(2\pi f_0 t) \Leftrightarrow \frac{A}{2}\delta(f - f_0) + \frac{A}{2}\delta(f + f_0)$.
6. Describe the meaning of the time and frequency scaling.

$$h(kt) \Leftrightarrow \frac{1}{|k|} H\left(\frac{f}{k}\right), \qquad \frac{1}{k} h\left(\frac{t}{k}\right) \Leftrightarrow H(kf)$$

7. Describe the meaning of the time and frequency shifting theorem.

$$h(t-t_0) \Leftrightarrow H(f)e^{-j2\pi f t_0}, \quad h(t)e^{j2\pi t f_0} \Leftrightarrow H(f - f_0)$$

8. Describe the following convolution and correlation process with graphical development sequence.

Convolution: $y(t) = \int_{-\infty}^{\infty} x(\tau)h(t-\tau)d\tau = x(t) * h(t)$

Correlation: $z(t) = \int_{-\infty}^{\infty} x(\tau)h(t+\tau)d\tau$

9. Describe the meaning of the following time- and frequency-convolution theorems and discuss how they can be used to save the computer time for convolution.

$$h(t) * x(t) \Leftrightarrow H(f)X(f)$$
$$h(t)x(t) \Leftrightarrow H(f) * X(f)$$

10. Describe the effects of choosing period (T_0) and sampling interval (T) of time sampling to the discrete-Fourier transformed, frequency domain signal, regarding Nyquist frequency and aliasing.