ECE102, Fall 2020 **Discussion 6**

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1. **Fourier transform of even and odd functions**

   (a) Show that the integral of the product of odd and even functions is zero.

   (b) Show that the fourier transform of a real even function is real.

   (c) Show that the fourier transform of a real odd function is imaginary.

   (d) Show that the fourier transform of an even function is even.

   (e) Show that the fourier transform of an odd function is odd.

2. **Symmetry properties of fourier transform**

   (a) By considering the fourier analysis equation or synthesis equation, show the validity in general of each of the following statements:

      i. If $x(t)$ is real-valued, then $X(j\omega) = X^*(-j\omega)$.

      ii. If $x(t) = x^*(-t)$, then $X(j\omega)$ is real-valued.

   (b) Determine which of the fourier transforms in Figures A and B correspond to real-valued time functions.

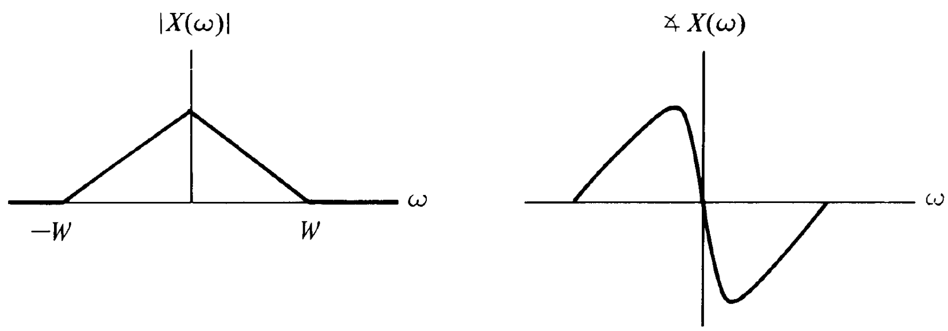

Figure 1: Figure A

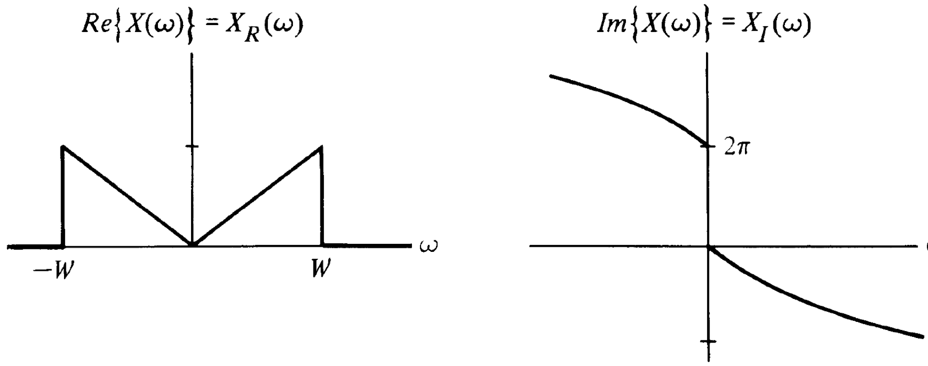

Figure 2: Figure B

3. **Fourier transform and its inverse**

   (a) Determine the energy in the signal $x(t)$ for which the Fourier transform $X(\omega)$ is given in the figure below.

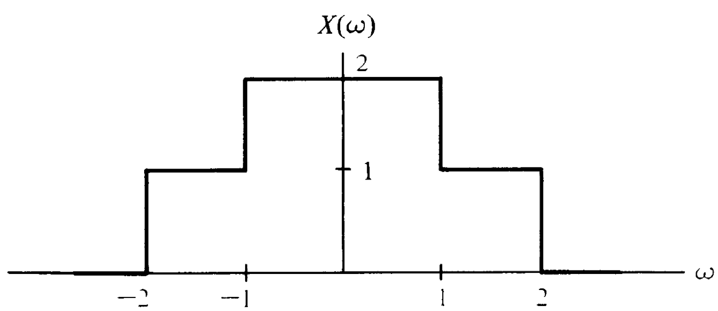

Figure 3: Fourier transform of $x(t)$ $(X(\omega))$

   (b) Find the inverse fourier transform of $X(w)$ of part (a).