

Problem-solving session

Properties and examples of FS

Jaime Laviada

Área de Teoría de la Señal y Comunicaciones
Universidad de Oviedo

Exercise 1: proofs

Prove the following properties of the FS:

- Periodic convolution:

$$f_0(x) * g_0(x) \leftrightarrow X_0 a(m) b(m)$$

- Multiplication:

$$f_0(x) g_0(x) \leftrightarrow a(m) * b(m)$$

- Inner product and Parseval's theorem:

$$\langle f_0(x), g_0(x) \rangle = X_0 \langle a(m), b(m) \rangle$$

Exercise 2: Properties of the FS

(Example 3.9 from Signals and Systems by A. Oppenheim)

- Determine the signal $f_0(x)$ given the following facts:
 - the signal is real and periodic with period $X_0 = 4$,
 - $a(m) = 0, \quad \forall |m| > 1$,
 - the signal with Fourier coefficients $b(m) = e^{-jm\frac{\pi}{2}} a(-m)$ is odd,
 - the energy per period is $\int_{\langle 4 \rangle} |f_0(x)|^2 dx = 2$.