

UNIT-1

(Lecture-3)

Even & Odd Signals

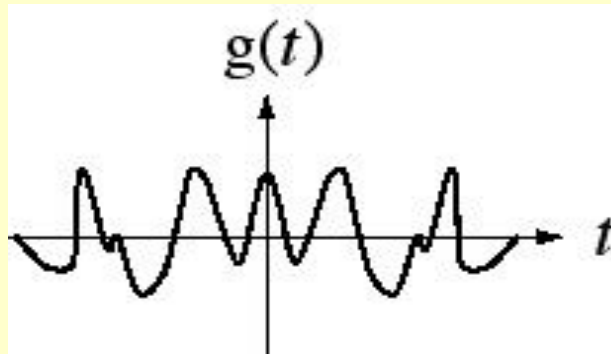
Classification of Signals

- Deterministic & Non Deterministic Signals
- Periodic & A periodic Signals
- **Even & Odd Signals**
- Energy & Power Signals

Even and Odd Signals

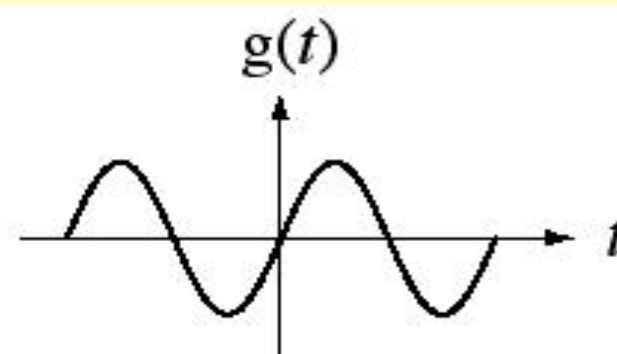
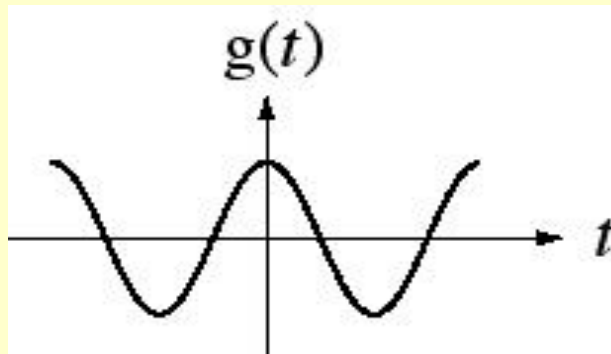
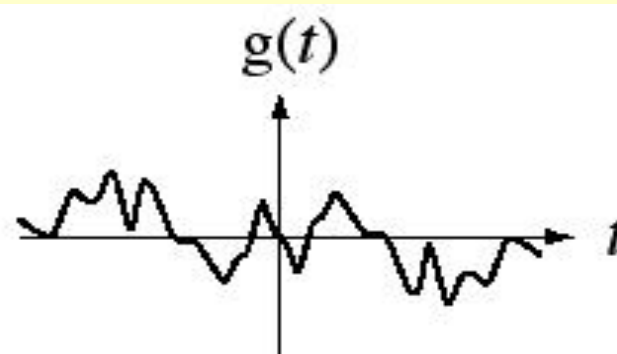
Even Functions

$$g(t) = g(-t)$$



Odd Functions

$$g(t) = -g(-t)$$



Even and Odd Parts of Functions

The **even part** of a function is $g_e(t) = \frac{g(t) + g(-t)}{2}$

The **odd part** of a function is $g_o(t) = \frac{g(t) - g(-t)}{2}$

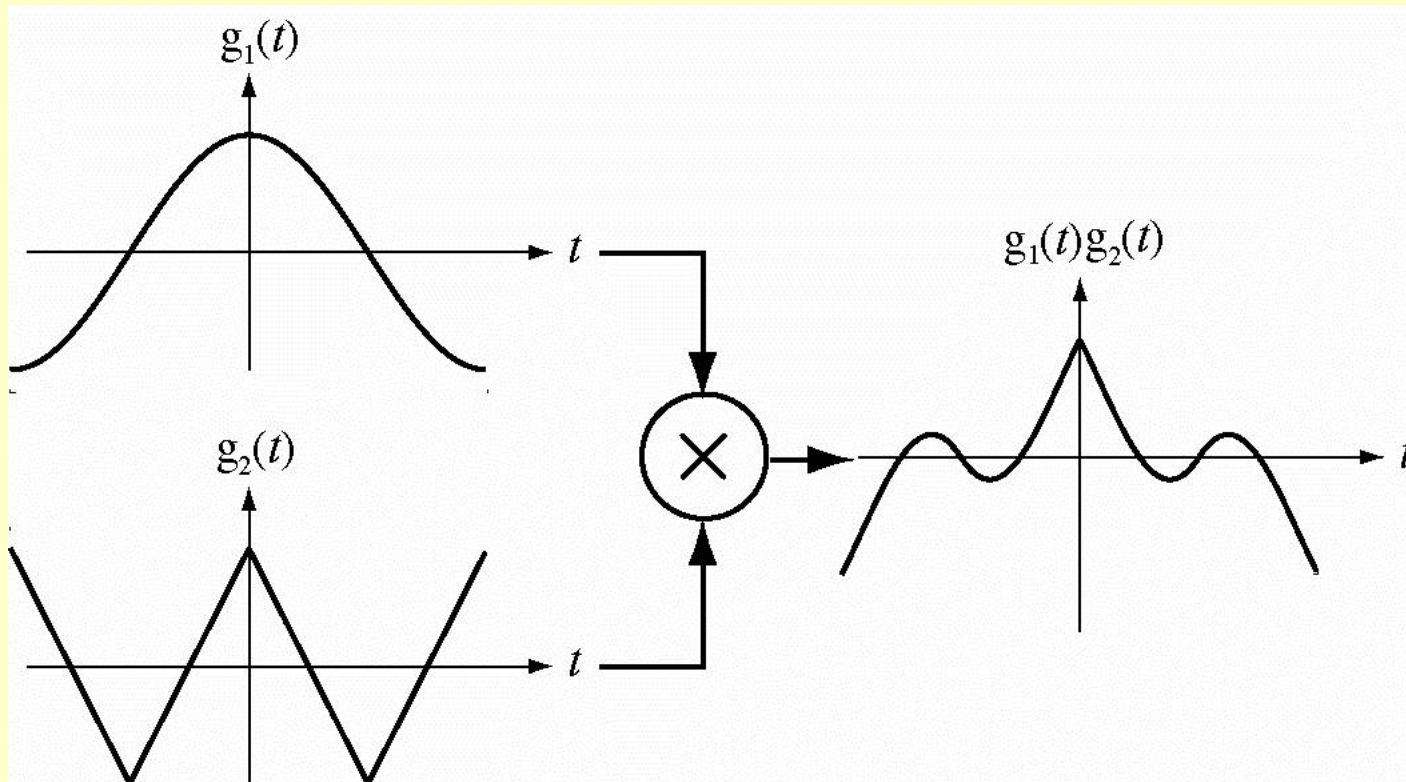
A function whose even part is zero, is odd and a function whose odd part is zero, is even.

Various Combinations of even and odd functions

Function type	Sum	Difference	Product	Quotient
Both even	Even	Even	Even	Even
Both odd	Odd	Odd	Even	Even
Even and odd	Neither	Neither	Odd	Odd

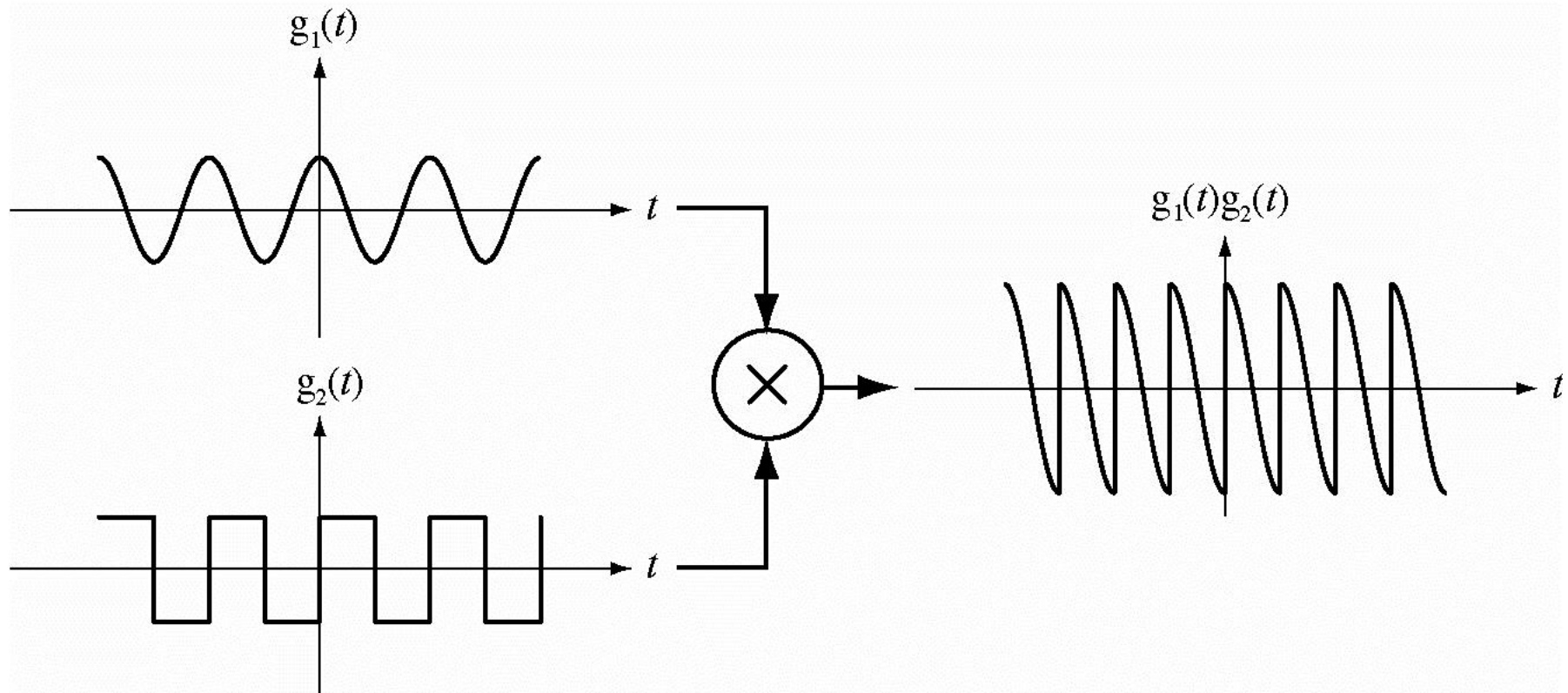
Product of Even and Odd Functions

Product of Two Even Functions



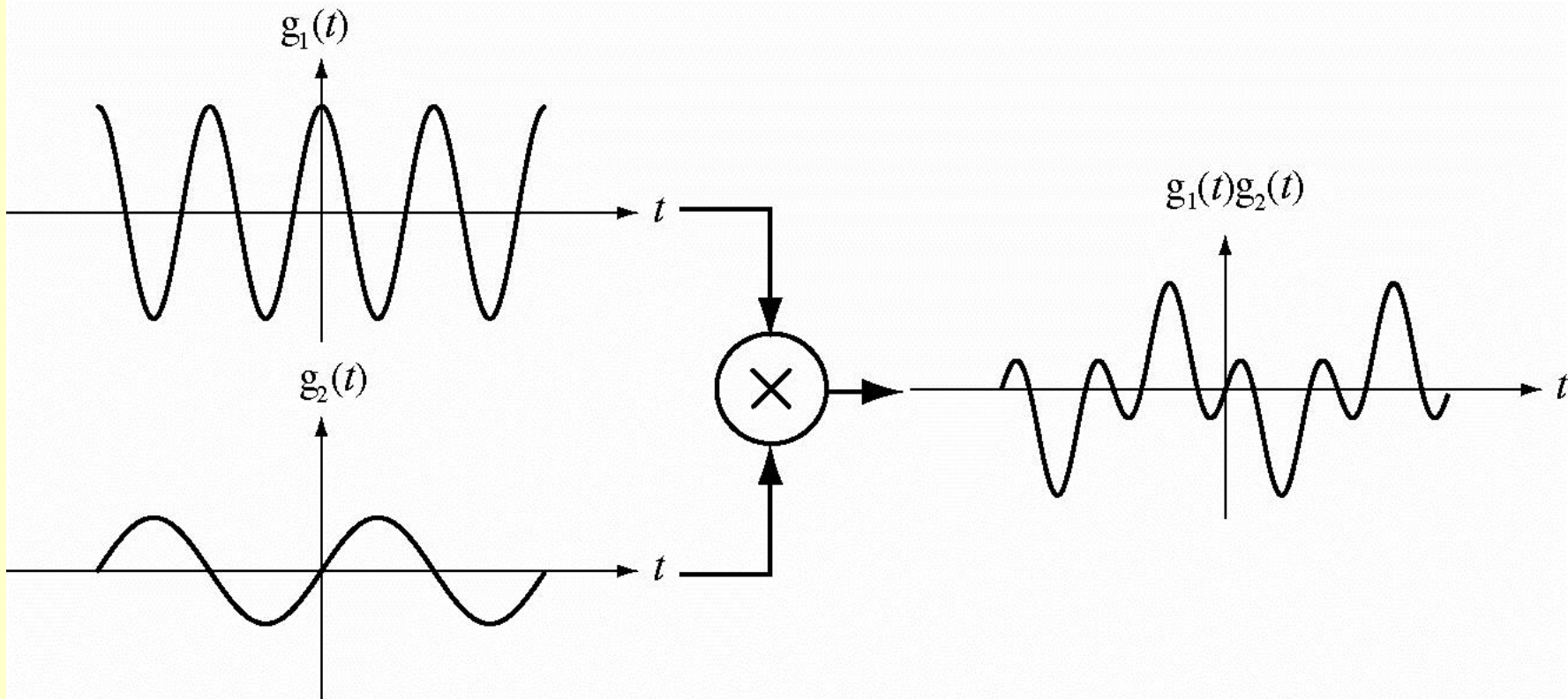
Product of Even and Odd Functions Contd.

Product of an Even Function and an Odd Function



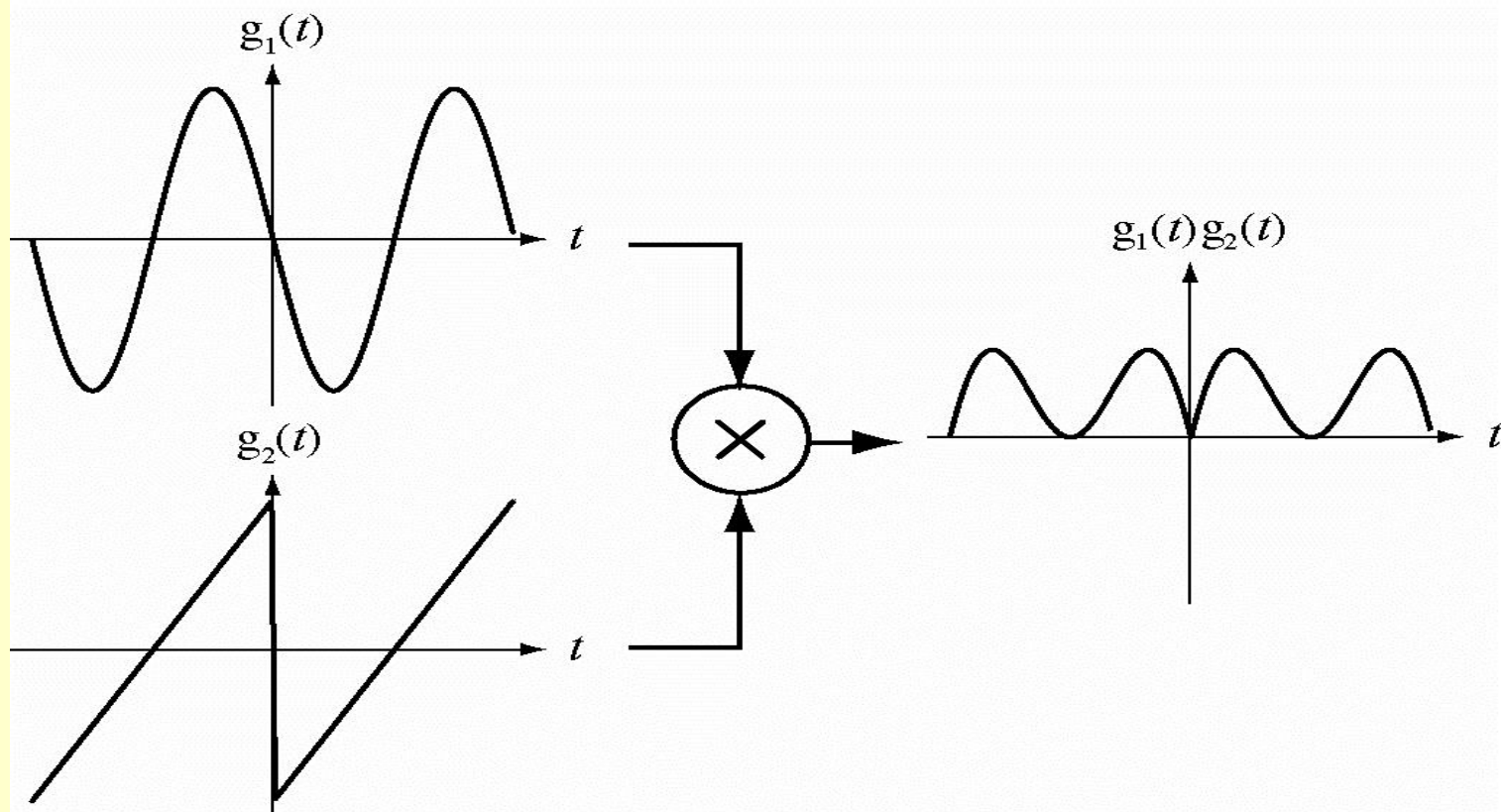
Product of Even and Odd Functions Contd.

Product of an Even Function and an Odd Function



Product of Even and Odd Functions Contd.

Product of Two Odd Functions



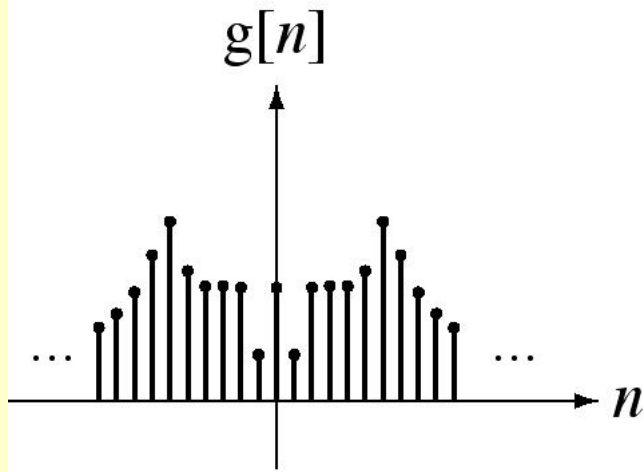
Derivatives and Integrals of Functions

Function type	Derivative	Integral
Even	Odd	Odd + constant
Odd	Even	Even

Discrete Time Even and Odd Signals

$$g[n] = g[-n]$$

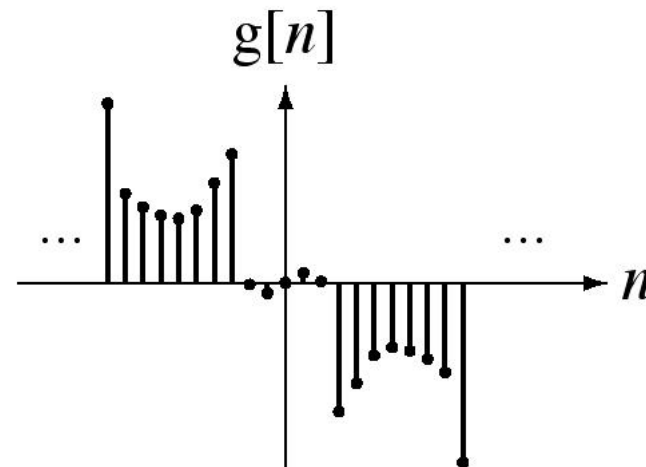
Even Function



$$g_e[n] = \frac{g[n] + g[-n]}{2}$$

$$g[n] = -g[-n]$$

Odd Function



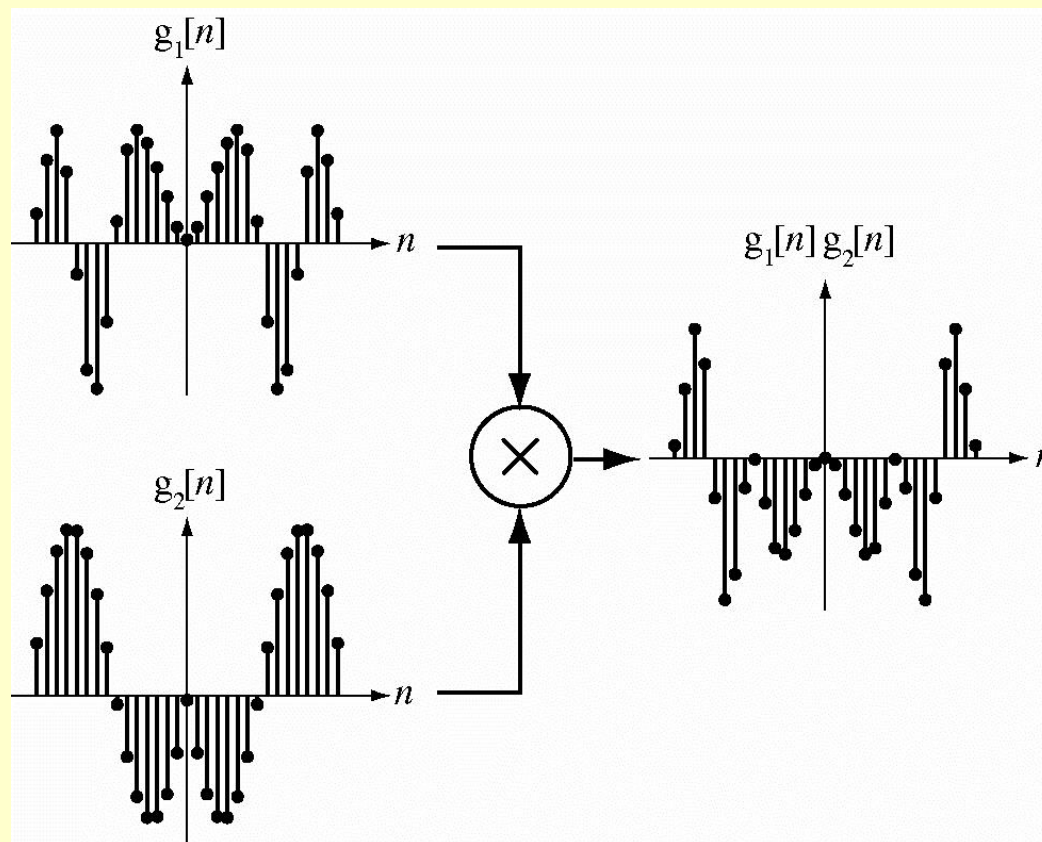
$$g_o[n] = \frac{g[n] - g[-n]}{2}$$

Combination of even and odd function for DT Signals

Function type	Sum	Difference	Product	Quotient
Both even	Even	Even	Even	Even
Both odd	Odd	Odd	Even	Even
Even and odd	Even or Odd	Even or odd	Odd	Odd

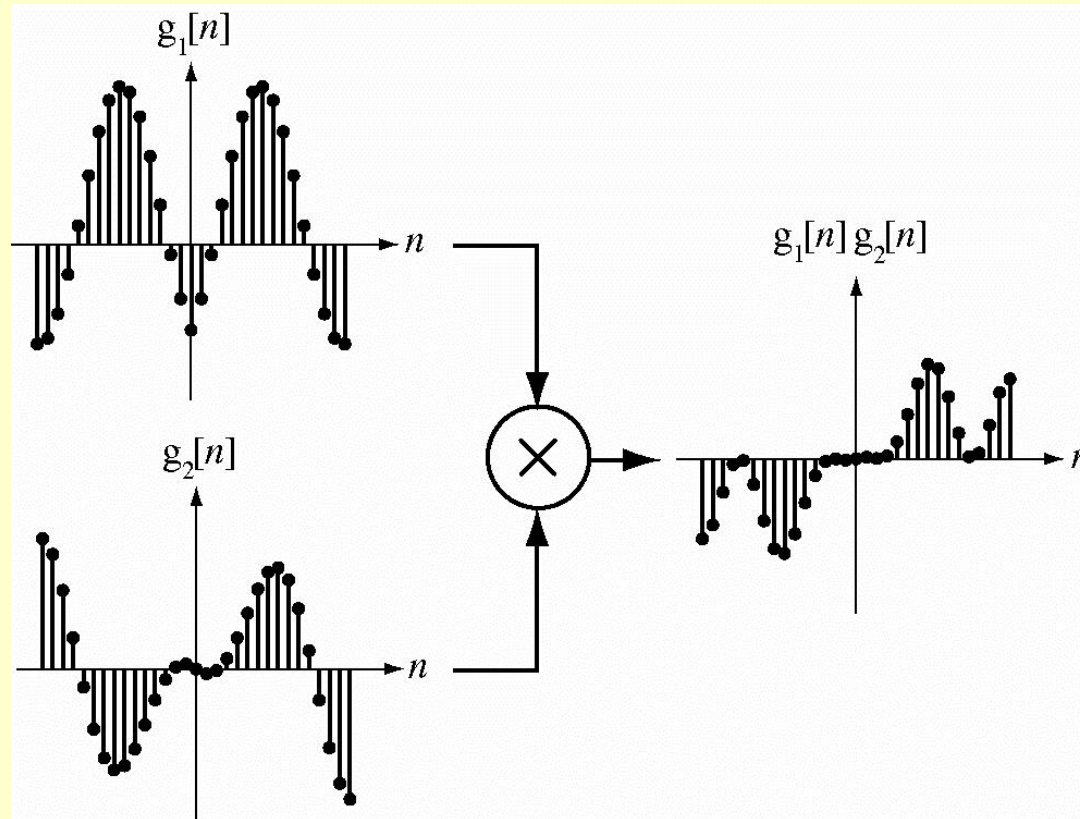
Products of DT Even and Odd Functions

Two Even Functions



Products of DT Even and Odd Functions Contd.

An Even Function and an Odd Function



Proof Examples

- Prove that product of two even signals is even.
- Prove that product of two odd signals is odd.
- What is the product of an even signal and an odd signal? Prove it!

Change $t \rightarrow -t$

$$x(t) = x_1(t) \times x_2(t) \rightarrow$$

$$x(-t) = x_1(-t) \times x_2(-t) =$$

$$x_1(t) \times x_2(t) = x(t)$$

$$x(t) = x_1(t) \times x_2(t) \rightarrow$$

$$x(-t) = x_1(-t) \times x_2(-t) =$$

$$x_1(t) \times -x_2(t) = -x(t) =$$

$$x(-t) \leftarrow \text{Even}$$