



Ministry of Higher Education

and Scientific Research

Al- Mustaqbal University College

Department of Medical Instrumentation Techniques Engineering

تكنولوجيا الكهرباء

Electrical Technology

Lecture 10

Lecture Name: TRANSFORMER

By

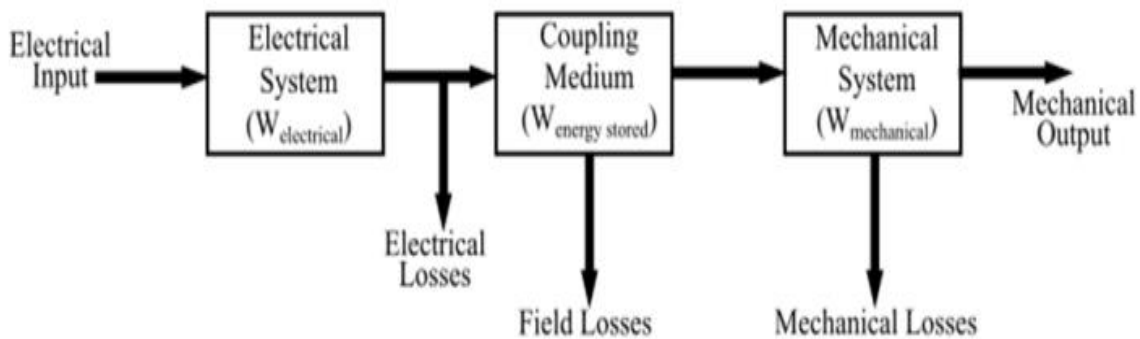
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Electromechanical Energy Conversion Device

An electromechanical energy conversion device is a device that converts electrical energy into mechanical energy and mechanical energy into electrical energy.

جهاز تحويل الطاقة الكهروميكانيكية هو جهاز يحول الطاقة الكهربائية إلى طاقة ميكانيكية والطاقة الميكانيكية إلى طاقة كهربائية.



• Electromechanical System in Simplified Form:

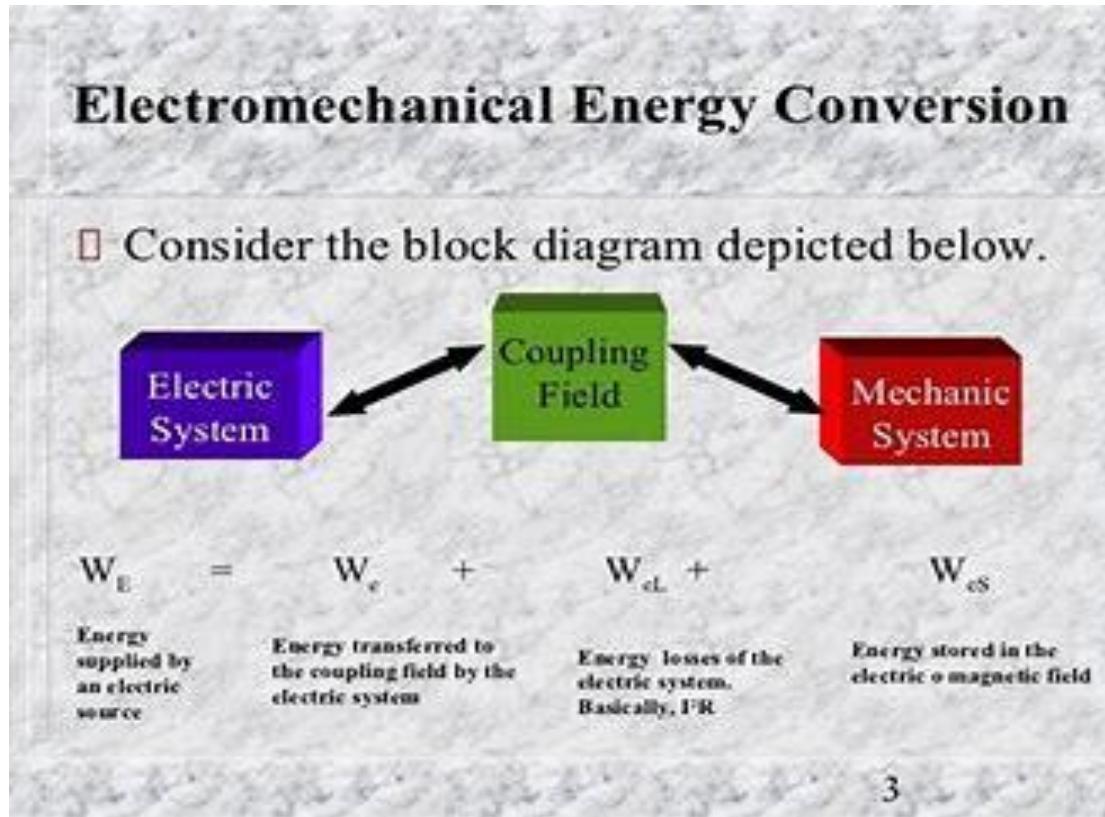


• Energy Distribution

$$W_E = W_e + W_{eL} + W_{eS}$$

$$W_M = W_m + W_{mL} + W_{mS}$$

- W_E = total energy supplied by the electric source (+)
- W_M = total energy supplied by the mechanical source (+)



- W_{eS} = energy stored in the electric or magnetic fields which are not coupled with the mechanical system
- W_{eL} = heat loss associated with the electric system, excluding the coupling field losses, which occurs due to:
 - the resistance of the current-carrying conductors
 - the energy dissipated in the form of heat owing to hysteresis, eddy currents, and dielectric losses external to the coupling field
- W_e = energy transferred to the coupling field by the electric system
- W_{mS} = energy stored in the moving member and the compliances of the mechanical system



- W_{mL} = energy loss of the mechanical system in the form of heat due to friction
- $W_F = W_f + W_{fL}$ = total energy transferred to the coupling field
 - W_f = energy stored in the coupling field
 - W_{fL} = energy dissipated in the form of heat due to losses within the coupling field (eddy current, hysteresis, or dielectric losses)
- Conservation of Energy
$$W_f + W_{fL} = (W_E - W_{eL} - W_{eS}) + (W_M - W_{mL} - W_{mS})$$
$$W_f + W_{fL} = W_e + W_m$$

Electromechanical Energy Conversion Principle MCQs

Q 1. The developed electromagnetic force and/or torque in the electromechanical energy conversion system act in a direction that tends _____.

تعمل القوة الكهرومغناطيسية المطورة و / أو عزم الدوران في نظام تحويل الطاقة الكهروميكانيكية في اتجاه يميل _____.

- A. to increase the stored energy at constant flux
- B. to decrease the stored energy at constant flux



- C. to decrease the stored energy at constant mmf
D. to increase the stored energy at constant mmf

- A - لزيادة الطاقة المخزنة بفيض ثابت
B - لتقليل الطاقة المخزنة بفيض ثابت
C - لتقليل الطاقة المخزنة عند ثبات mmf.
D - لزيادة الطاقة المخزنة عند ثبات mmf

Q 2. In electromechanical energy conversion devices (e.g. generators and motors), a small air gap is left between the stator and rotor in order to _____.

س 2. في أجهزة تحويل الطاقة الكهروميكانيكية (مثل المولدات والمحركات) ، تُترك فجوة هواء صغيرة بين الجزء الثابت والدوار من أجل _____.

- A. reduce the reluctance of the magnetic path
B. increase flux density in the air gap
C. permit mechanical clearance
D. avoid saturation of the field

- A - تقليل ممانعة المسار المغناطيسي
B - زيادة كثافة الفيض في فجوة الهواء
C - السماح بإزالة التأثير الميكانيكي
D - تجنب تشبع المجال