2. Electrical AC Machines

- Types of AC machines: Induction and synchronous motors
- Types of DC machines: Separately, shunt, series, compound, permanent magnet (excited) DC motors
- A number of factors must be considered when you select an AC motor for a particular application
  - Cost
  - Power density, volume of motor
  - Thermal capacity
  - Torque-speed profile
  - Efficiency
  - Acceleration
  - Peak torque capability

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- Motor rating
  - For variable speed drive, the selection of motor torque and power ratings are not straightforward as in the case of constant speed drive
  - In varying load case, the motor torque and power are selected on the basis of effective torque and power
  - The effective torque is calculated from the load profile as:

$$T_{eff} = \sqrt{\frac{\sum_{i=1}^{n} T_i^2 t_i}{\sum_{i=1}^{n} t_i}}$$

  where T_i is the average torque during the period t_i

3. Control system

- It controls the input of power converter to match the load and motor through the power converter

- The input of control system consists of:
  - Torque, flux, speed
  - The measured torque, flux, and speed for feedback control
  - Temperature feedback and instantaneous currents in the motor and/or converter
  - The gains of Proportional-Integral (PI) and/or Proportional-Resonant (PR) controllers

- The output of the control system is only the final gate signals which are directly issued to the gates of power devices

- Examples:
  - Microprocessors
  - Microcontrollers
  - Digital Signal Processors (DSPs)
  - Field Programmable Gate Arrays (FPGAs)

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