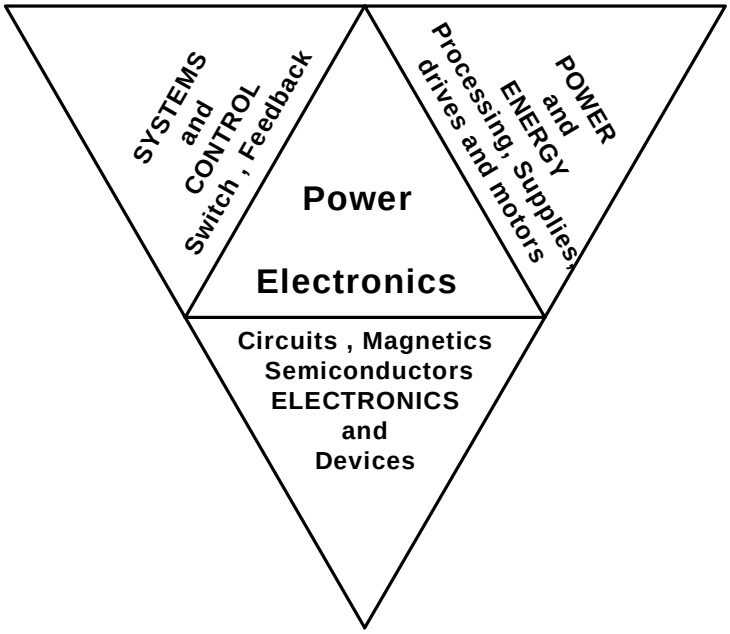
Introduction to Power Electronics



The design Process

Each application is a special case

1- General principles
Have to be well known, fully understood physically

2- Component ratings
Principles of heat generation and heat transfers. Orders of magnitude.

3- Circuit limitations:
Critical parameters of devices, cost and maintenance associated with components

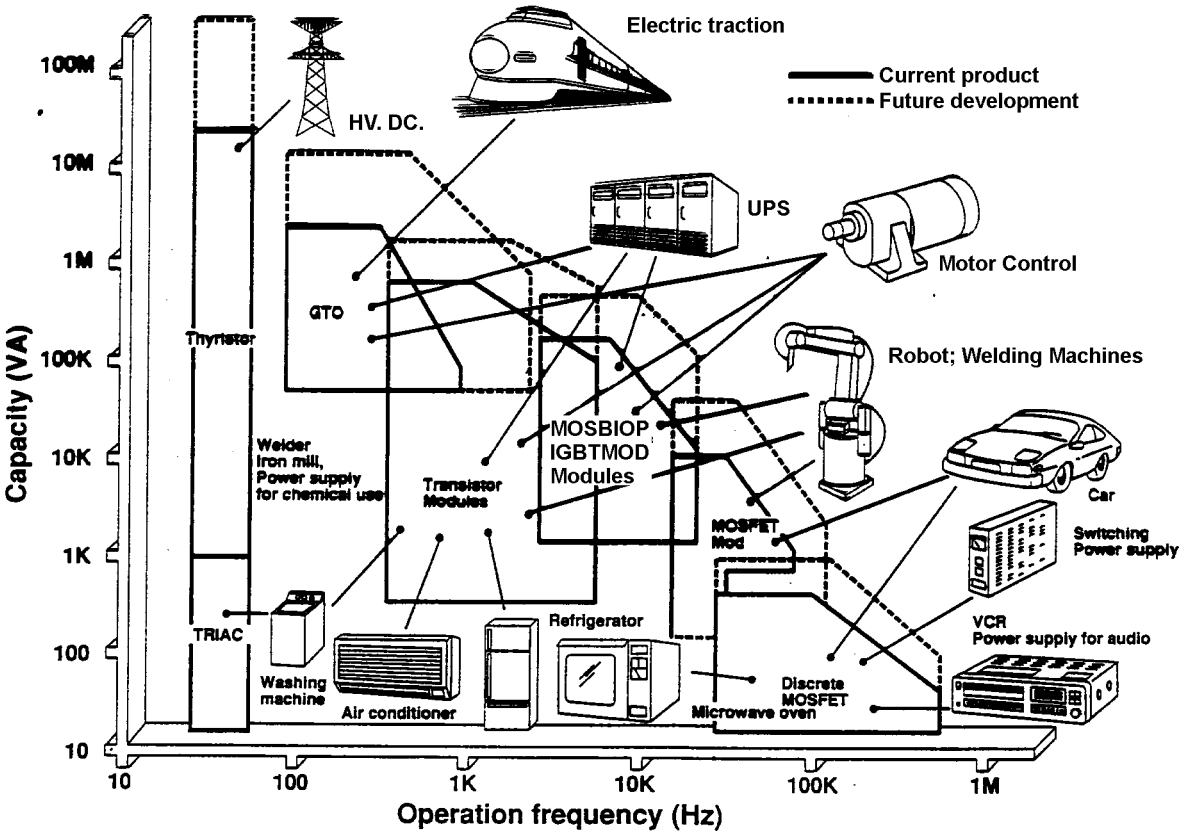
4- Control Circuits
General principles and practical control. Sensors and signal conditioning

5- Performance:
To be familiar with testing and acceptance testing.

6- Modelling:
Reality ?? Fiction ?? Range of validity

7- Harmonic generation
Potential problems in electrical apparatus. Potentiel problems in Electromagnetic Interference.

Application of Power Devices



Power Electronics covers a wide range of frequencies (DC to 100MHtz) for generation of power waves. Furthermore, because of switching circuits, very high frequency transients are generated causing component failure or EM interference. These transients are very difficult to detect because of the mixed “low” frequency and “very high” frequency components coexisting.

The range of currents generated vary from micro amperes to hundred thousands of amperes, and voltages are also from fraction of voltages to megavolt levels.

This 3 dimentional problem space is further complicated by cost considerations and engineering implementation management.

Types of Converters

1- AC Voltage Controllers

fixed V.AC >>> variable V.AC

2- RECTIFIERS

a) Uncontrolled:
fixed V.AC >>> fixed V.DC (line commutation)

b) Controlled:
fixed V.AC >>> variable V.DC (line commutation)

3- DC to DC (Choppers)

fixed V.DC >>> variable V.DC (forced commutation)

4- INVERTERS:

a) Uncontrolled:
fixed V.DC >>> fixed V.AC / variable frequency

b) Controlled:
fixed V.DC >>> variable V.AC / variable frequency

5- CYCLOCONVERTERS

fixed V.AC >>>> variable V.AC / variable frequency