

# Main Areas in Electronics

## *Signal Electronics*

- ▣ Electronic circuits process signals
- ▣ Electronic circuits contain electronic-devices
- ▣ Dominant application of Electronics is to process information.
- ▣ The biggest user of semiconductor Electronic devices is the computer industry.
- ▣ Next user is the consumer electronics.
- ▣ The primary function is to process information.

# Main Areas in Electronics

## *Power Electronics*

- ▣ Power Electronic circuits process electric power
- ▣ Power electronics uses electronic devices that can handle large power.
- ▣ Processing of Electric Power is known as “Power Conditioning”.
- ▣ Power Semiconductor devices are operated in switching mode to get higher efficiencies.

## *Scope of Power Electronics*

- ▣ All electronic systems are operated by power from a wall plug or battery
- ▣ It is needed to convert electrical energy from the form supplied by the source to the form required by the load.
- ▣ In some cases the power circuit converts electric energy to the form required by the electromechanical system, such as an electric motor.

# Power Conditioners

## ▣ Power Converters

- AC/DC converters
- DC/DC converters
- DC/AC converters
- AC/AC converters

# AC to DC Converters

- ▣ Uncontrolled AC to DC converters-Rectifiers
- ▣ Semi-Controlled AC to DC converters
- ▣ Fully controlled AC to DC converters
- ▣ Three-Phase, 6-step AC to DC converters
- ▣ 12-step and 24-step AC to DC converters
- ▣ Pulse Width Modulation AC to DC converters

# DC to DC converters

- ▣ Linear
  - *Series type*
  - *Shunt type*
- ▣ Switch mode
  - *Non Isolated converters*
    - Buck converters
    - Boost converters
    - Polarity inverting Converters
  - *Isolated converters*
    - Forward converters
    - Fly back converters

## DC to AC converters

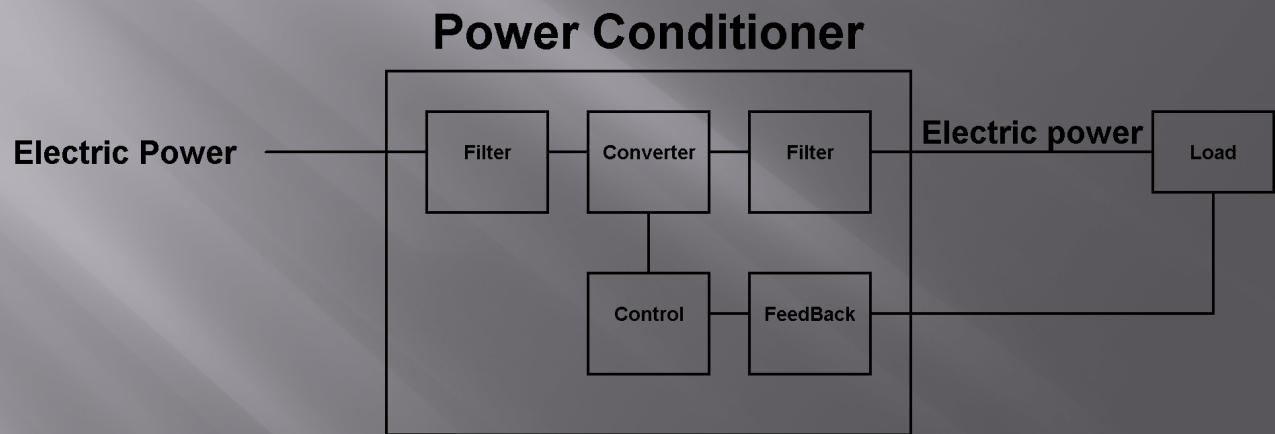
- ▣ Square wave DC to AC converter
- ▣ Quasi-Square wave DC to AC converters
- ▣ Multi-step DC to AC converters
- ▣ Pulse Width Modulation DC to AC converters
  - *Natural Sampling PWM*
  - *Regular Sampling PWM*
  - *Selective Harmonic Reduction PWM*

## AC to AC converters

- ▣ Input is AC with fixed voltage and frequency
- ▣ Output is AC with variable voltage and variable frequency.
- ▣ Cycle-Converters
- ▣ Matrix Converters



# Power Conditioner



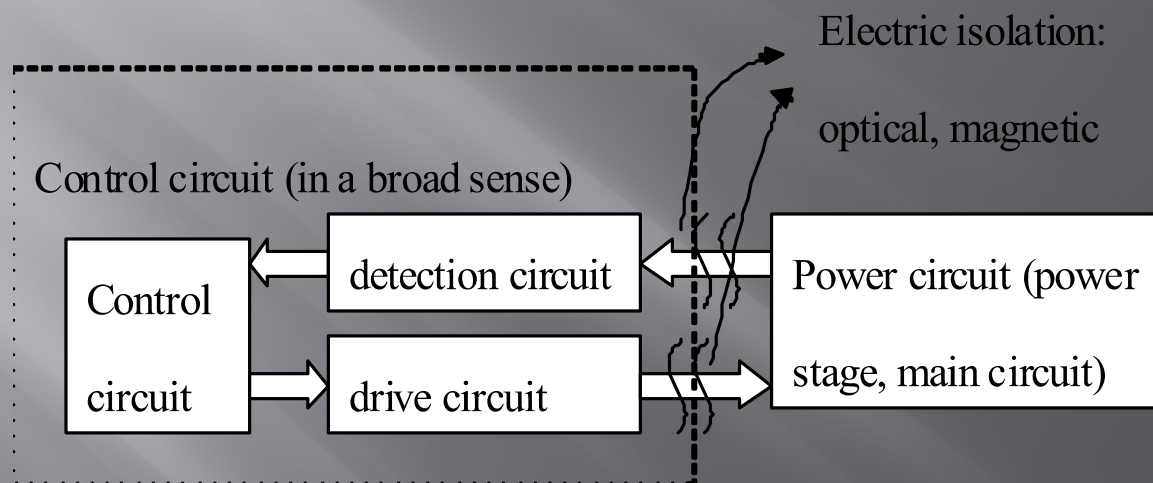
# Power Conditioners Applications

- ▣ Railway Traction
- ▣ Ship Propulsion
- ▣ Paper Rolling Mills
- ▣ Steel Rolling Mills
- ▣ Wire Drawing
- ▣ Servo Drive Applications
- ▣ Chemical Processing Industries

# Power Conditioners Applications

- ▣ DC Power Supplies
- ▣ Battery Chargers
- ▣ UPS
- ▣ Voltage Regulators
- ▣ High Frequency Heating
  - *Sealing PCV*
  - *Welding Metals*
  - *Melting of Metal*
  - *Tempering and Annealing*

# Configuration of systems



Protection circuit is also very often used in power electronic system especially for the expensive power semiconductors.

# Conclusions

- ▣ The scope of power electronic circuit design is discussed to process Electric Power under high voltage -high current Scenario.
- ▣ All four types of power converters are introduced.
- ▣ The use of Power Electronic systems are increasing and main concern is the power quality.
- ▣ The research in this area is mainly addressing these power quality issues

**Thank you**

*For your attention*