# POWER ELECTRONIC

ASNIL
ELEKTRO FT - UNP

# Sinopsis

Mata kuliah ini membahas tentang komponen elektronika daya, Rangkaian penyearah (rectifier), DC chopper, Rangkaian Inverter, Pengatur tegangan bolak-balik ( ac controller dan cyclo converter), Teknik komutasi, harmonic problems.

# Penilaian

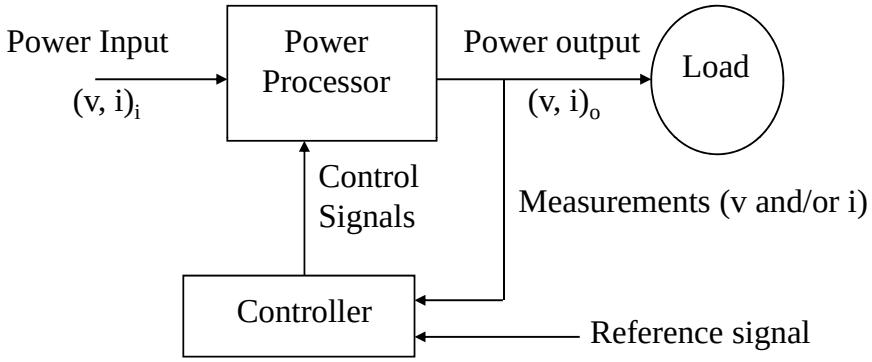
- Kehadiran dan kreatifitas 10 %
- Tugas 20 %
- Ujian tengah semester 30 %
- Ujian akhir semester 40 %

# Referensi

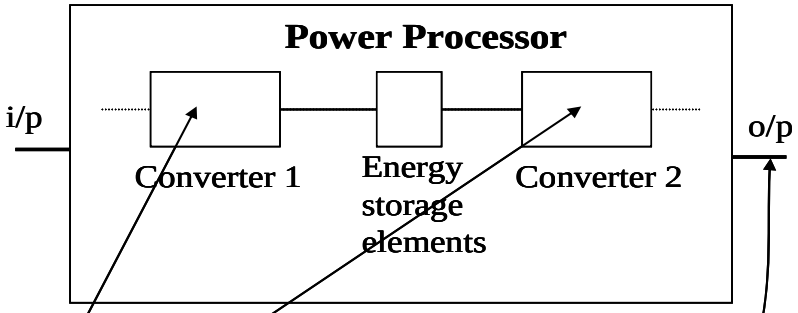

1) Timothy L. Skvarenina., 2002, “The Power Electronics Handbook”, CRC Press, New York.
2) Paice, Derek. A., 1996, “Power Electronic Converter Harmonic”, IEEE Press, New York.
3) Rashid, “Power Electronics”, 3rd ed., Prentice Hall, 2004.

# What is Power Electronics?

**Circuits/systems to process and control the flow of electrical energy/power from input source optimally suited to user load**




**Power Electronic system**

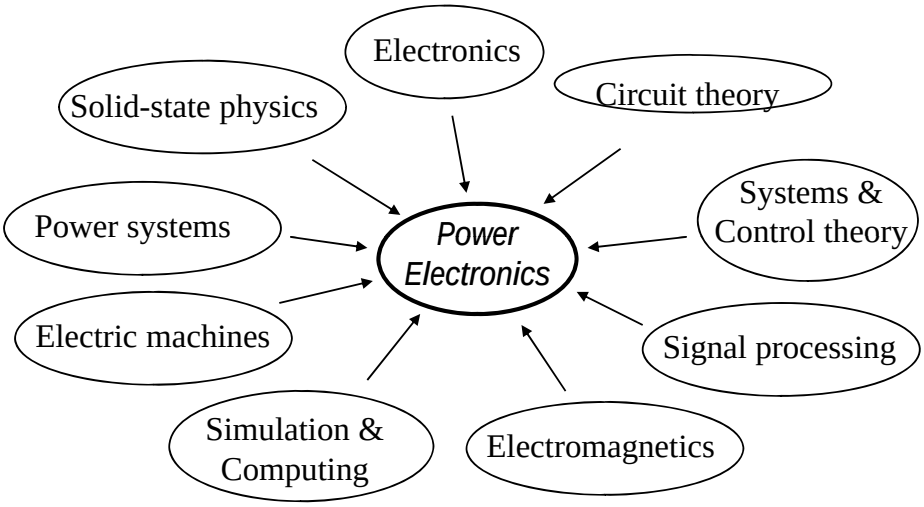



**Power Input:**
from electric utility, 1 or 3 phase, 50 or 60 Hz: ac input
from dc supply/battery: dc input
from previous converter output: ac/dc input

**Power Converter Core :** Using
BJT/ MOSFET/ SCR/ GTO/ IGBT/ MCT as switch,
Diode, L and C as energy manipulators
Because converter core used switches, the electronic circuits are also called **Switch-mode Power Supplies**

**Power Output:** to load (load can be of R or L or R-L nature)
output parameters: dc/ac voltage, dc/ac current, frequency & number of phase

# *Scope of Power Electronics*



# Lingkup Elektronika Daya

- Elektronika (electronics)

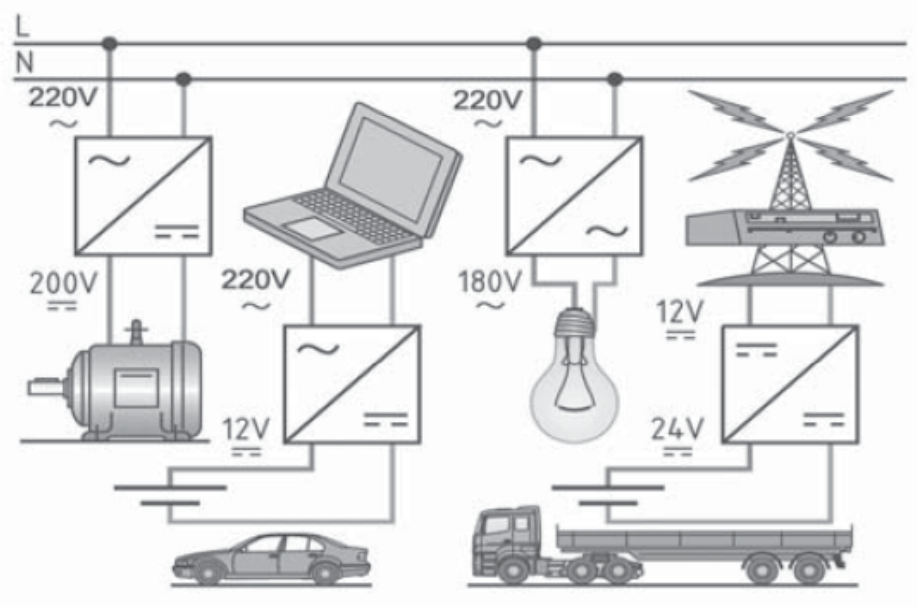
  *mempelajari piranti semikonduktor dan rangkaiannya pada tingkat daya yang kecil*

- Ketenagaan *(power)*

  *membahas tentang pembangkitan, transmisi, distribusi energi listrik, dan mesin listrik*

- Pengaturan *(control)*

  *membahas stabilitas dan karakteristik respon dari suatu sistem rangkaian-tertutup*




Pemanfaatan energi listrik

# Elektronika daya

Disiplin ilmu yang mempelajari penggunaan teknologi elektronika dalam konversi energi (daya) elektrik.

Mengapa energi (daya) elektrik perlu dikonversikan?

- Hampir semua peralatan listrik bekerja kurang efisien atau tidak bisa bekerja pada sumber energi (daya) elektrik yang tersedia.
- Banyak pembangkit energi (daya) elektrik nonkonvensional mempunyai bentuk yang tidak kompatibel dengan sumber energi (daya) elektrik lainnya.

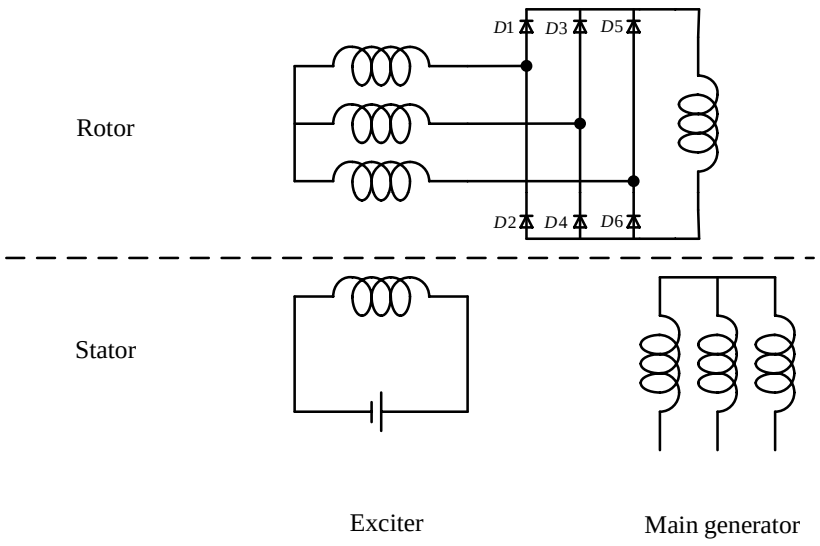
# APLIKASI DI RUMAH TANGGA

- Adaptor
- Uninterruptible Power Supply (UPS)
- Lampu Hemat Energi
- Mesin Las Listrik
- Oven Microwave

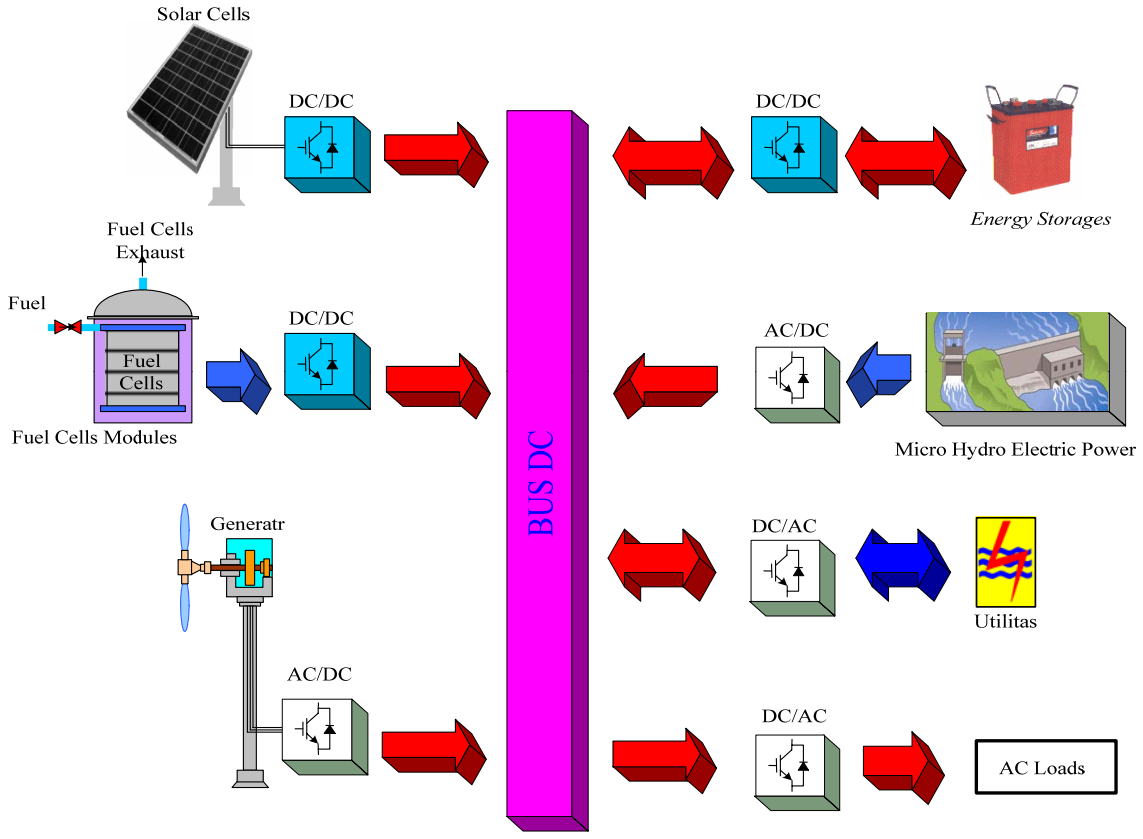
# Power Electronic Applications in Power Generation

- Excitation system
- Automatic Voltage Regulator
- Variable Speed Power Generation (Hydro, Wind, Microturbine gas)
- Power Conditioners for Renewable Power Generation (Fuel cells, solar cells)
- Energy Storage

# Excitation System in Brushless AC Generator



# Renewable Energy System

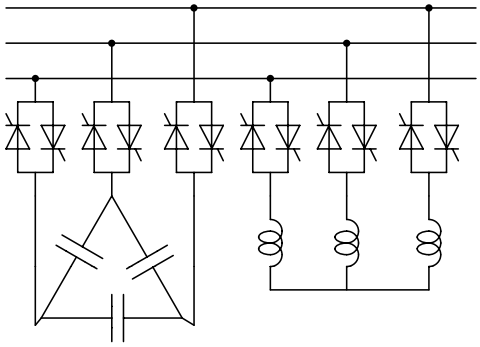


# Rote Island Hybrid Power System


# Power Electronic Applications in Power Transmission

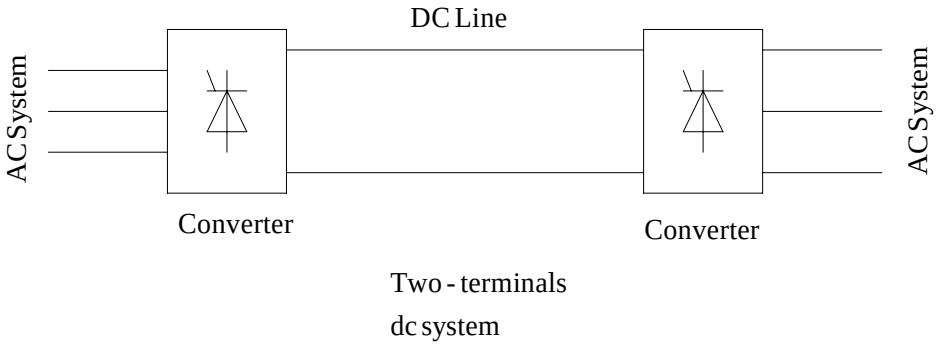
- High-Voltage Direct Current Transmission
- Static VAR Compensators
- Series Compensation
- Phase Shifters
- Dynamic Braking
- Flexible AC Transmission System
- High-Speed Circuit Breakers

# Static VAR Compensator



- Improving power factor
- Reducing voltage drop and losses
- Increasing maximum power transfer
- Improving damping factor

# HVDC Transmission System

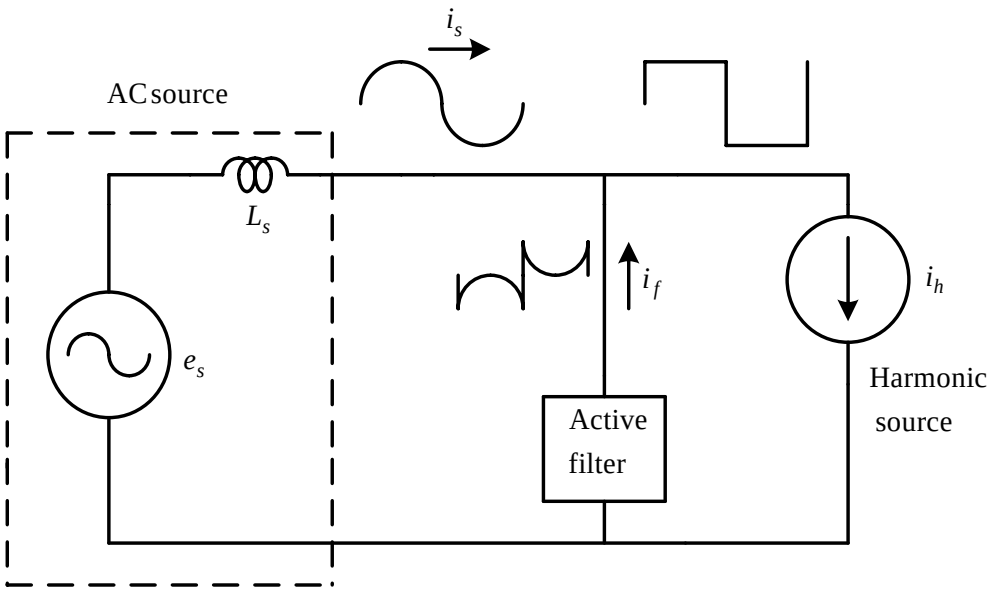



- Asynchronous links
- Suitable for long distance transmission and underground cable transmission
- Improving damping factor

# Power Electronic Applications in Power Distribution

- Static VAR Compensators
- Power Conditioners
- Active Filters
- Unified Power Conditioners
- Dynamic Voltage Restorers
- High-Speed Circuit Breakers
- Light High-Voltage Direct-Current Distribution
- Power conditioners for distributed power generation

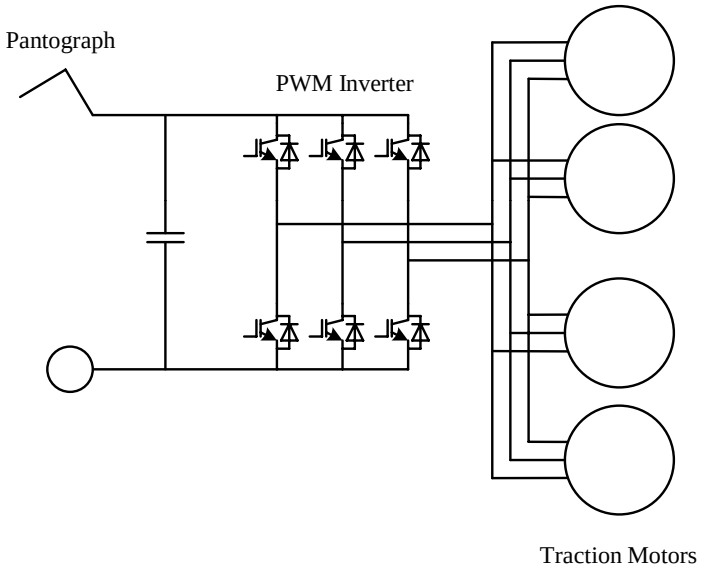
# Active Filter



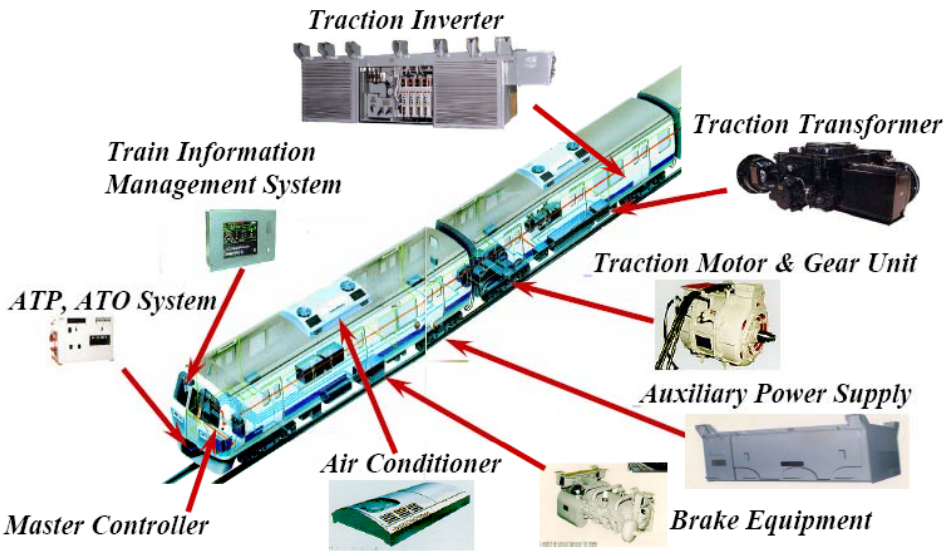
# Power Electronic Applications in Transportation Industries

- High-Speed Trains
- Electric vehicles
- Elevators (lift)
- Airplanes
- Ships
- Unmanned vehicles (pesawat tak berawak)

# PWM Inverter for Electric Traction



# Electric Traction



# Scope and applications

(a) *Residential*
- Refrigeration and freezers
- Space heating
- Air conditioning
- Cooking
- Lighting
- Electronics (personal computers, other entertainment equipment)

(b) *Commercial*
- Heating, ventilating, and air conditioning
- Central refrigeration
- Lighting
- Computers and office equipment
- Uninterruptible power supplies (UPSs)
- Elevators

(c) *Industrial*
- Pumps
- Compressors
- Blowers and fans
- Machine tools (robots)
- Arc furnaces, induction furnaces
- Lighting
- Industrial lasers
- Induction heating
- Welding

(d) *Transportation*
- Traction control of electric vehicles
- Battery chargers for electric vehicles
- Electric locomotives
- Street cars, trolley buses
- Subways
- Automotive electronics including engine controls

(e) *Utility systems*
- High-voltage dc transmission (HVDC)
- Static var compensation (SVC)
- Supplemental energy sources (wind, photovoltaic), fuel cells
- Energy storage systems
- Induced-draft fans and boiler feedwater pumps

(f) *Aerospace*
- Space shuttle power supply systems
- Satellite power systems
- Aircraft power systems

(g) *Telecommunications*
- Battery chargers
- Power supplies (dc and UPS)