

Industrial Electronics

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1 Introduction

The class focuses on power conversion for a systems Converters can be classified as

- ac-ac
- ac-dc
- dc-ac
- dc-dc

1.1 Examples and applications

1. Fan regulator
 2. Light dimmer
 3. Motor speed controller
 4. Inverters
 5. Solar power systems
 6. Power supply systems
- Electrical motion caused about by motors and control
 - Electric temperature change(heating,cooling, welding) and control
 - Induction

2 Power Efficiency

Ideal case has a power Efficiency of one such as inverters and rectifiers
powerlosses = heat = cooling = costs

Comparisons between ICEs and EVs

if you're comparing look for relatively similar components eg bajaj to zembo
Cost is relative of the applications

3 Componentts

ideally lossless components. Periodic signals. Here we look at average power in a period equal to zero

Componentts

1. Capacitors
2. Ideal inductor/ transformer

3. Electronic component(diodes, transistors, thyristors)
4. for BJTs either in cutoff or in saturation (switching mode)
5. Avoid resistance as resistors are lossy

switching mode power supplies (SMPS) even stepping up and down we would love to avoid resistors

4 switching

4.1 ideal switch characteristics

on state, ideal switch has zero voltage and non zero current

Capable of carrying infinite current

off state has non zero voltage and zero current accross

it must be able to block an infinite voltage

Why is it beter to have a robot

mechanical switches, bouncing

electromagnetic switches(em relays in cars)

electronic switches(diodes,transistors, mosfets) temperature bound, leakage current

compare the different types of switches rectifiers would require 50Hz switching

Single phase or three phase

teslaa charge, mail mill three phase best for power Efficiency in machines thus if you need a 3 phase machine you can wire up 3phase. Expense, custom components Factory rates. Cheap to buy , cheap to operate

ideal vs ral world

how is 3 phase power if some phases aren't used

4.2 Real switch characteristics

1. On state

4.3 switch control

brick wall is an ideal filter

uncontrolled switch (diode)

fully controlled switch (3 legged)

semi controlled- turn on with trminal but can't swithc off with terminal

FET is voltage controlled, BJT is current controlled

5 device physics

5.1 p-n junction

junction forward bias on switch, conductor reverse bias off switch, insulator

power diode the junction might be doped with p+, n-, n+ so as to reduce the available electrons thus increasing the insulation properties for the diode to switch. This gives a non even depletion region

1. Physically larger
2. vertical configuration

Useful for rectification. We can have a break down voltage of about 2kV IV characteristic graph

Some rectification circuits are applied after a step down transformer as dc devices are usually of low power

Welding machines?

Homework

D52P2400s diode

Junction capacitance

Differences between power diodes and normal diodes, transient effects, reverse recovery time

Switching losses

5.2 Bipolar Junction transistors Q