SWITCHED MODE
POWER SUPPLY (SMPS)
Contents:-

- General description of Power Supply
- Basic principle of PSU and description of main parts
- Block diagram of SMPS
- Comparison over Linear supply
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- What is UPS
- Type of UPS
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- Block diagram of Different UPS
- Advantages/Disadvantages of UPS
- Applications of UPS
Power supplies provide the necessary power, voltage and current requirements for electronic devices.

They usually change ac to dc voltage.
  - For example, 120 volts ac is changed to 13.8 volts dc.
Basic Principles of PSU Circuits

Consist of:

1. Transformer - steps ac voltage up or down.
2. Rectifier Diodes - change ac to “ripple” dc.
3. Filter Network - includes capacitors and inductors, smooth out the ripples.
4. Voltage Regulator - keeps the voltage constant.
Power Supply Specifics

Half Wave - Full Wave Rectifier

Bridge Rectifier
Capacitors and inductors are used in power supply filter networks. The capacitors and inductors smooth out the “ripple” ac to dc.
Power Supply Safety

- Grounding is important.
- Connection integrity is important.
  - Somewhere neutral and ground are connected together.
- Bleeder resistors across the filter capacitors “bleed off” charge when supply is turned off.
Switched Mode Power Supply:

- An electrical power supply that incorporates a switching regulator to convert electrical power efficiently.

- It transfers power from a source, to a load, while converting voltage and current characteristics.
- Voltage regulation is achieved by varying the ratio of on-to-off time.
Block diagram of a SMPS

Functional Block Diagram of SMPS
Linear and SMPS Comparison

**Efficiency:**
- Efficiency comparisons between series pass and switch mode power supply

**Cost:**
- Cost comparison between series pass and switch mode power supply

[Graph showing efficiency comparison between series pass and switch mode power supply across different power supplies and the corresponding cost effectiveness.]
Linear and SMPS Comparison

- **Volume / Weight:**

- **Adjustable Frequency:**
  Switch mode allows adjusting the frequency from 1 to 300 kHz

- **Flexibility:**
  SMPS more flexible due to capability of adjusting frequency
Linear and SMPS Comparison

- Noise:

Noise comparison between series pass and SMPS
Advantages & Disadvantages of SMPS over Linear Power Supplies:

Advantages of SMPS:
1. Lower weight
2. Smaller size
3. Higher efficiency
4. Lower power dissipation
5. Wide ac input voltage range
6. Reduced costs

Disadvantages of SMPS:
1. Complexity of the circuit
Applications of SMPS:-

- 1. Machine tool industries
- 2. Security Systems (Closed circuit cameras)
- 3. Support supplies with PLC's
- 4. Personal Computers
- 5. Mobile Phone chargers
SMPS in Indian markets:

- iball 600W Rs. 4700
- Antec 750W Rs. 6600
- Cooler master 550W Rs. 3800
- Seasonic 500W Rs. 3600
- UMAX 450W Rs. 570
- Corsair 750W Rs. 10700
UNINTERRUPTIBLE POWER SUPPLIES

AN UNINTERRUPTIBLE POWER SUPPLY (UPS) IS A DEVICE THAT HAS AN ALTERNATE SOURCE OF ENERGY THAT CAN PROVIDE POWER WHEN THE PRIMARY POWER SOURCE IS TEMPORARILY DISABLED.

THE SWITCHOVER TIME MUST BE SMALL ENOUGH TO NOT CAUSE A DISRUPTION IN THE OPERATION OF THE LOADS.
WHY USE A UPS?

- Protects against multiple types of power disturbances
- Only device that protects against an outage
- Offers protection against
  - Equipment not operating properly
  - Computer and equipment damage
  - Data loss
  - Time and expense to recover back to where you were, if even possible
Types Of UPS

- UPS
  - ON Line UPS
  - OFF Line UPS
UPS COMPONENTS

• CONVERTER - AC TO DC
  ➢ SPD - PROTECTS AGAINST SPIKES AND TRANSIENTS

• BATTERY
  ➢ STORED ENERGY DEVICE - PROTECTS AGAINST INTERRUPTIONS

• INVERTER - DC TO AC
  ➢ WAVEFORM SYNTHESIS - PROTECTS AGAINST DC OFFSET AND INTERHARMONICS
  ➢ FILTER - PROTECTS AGAINST HARMONICS, NOTCHING AND NOISE
  ➢ VOLTAGE REGULATOR - PROTECTS AGAINST SAGS, SURGES AND FLUCTUATIONS

• MONITOR AND CONTROL HARDWARE / SOFTWARE
CONVERTER
AC TO DC

INVERTER
DC TO AC

AUTOMATIC SWITCH

CRITICAL LOAD
(AC)

BATTERY

INVERTER FAIL

BLOCK DIAGRAM
ON LINE UPS
ADVANTAGES / DIS-ADVANTAGES OF THE DIFFERENT UPS ARCHITECTURES

OFF LINE UPS ADVANTAGES

➢ AC TO DC CONVERTER / BATTERY CHARGER DOES NOT HAVE TO PROVIDE FULL LOAD POWER (POTENTIALLY CHEAPER)
➢ LESS STRESS ON DC TO AC INVERTER SINCE IT RUNS AT NO LOAD UNTIL UPS SWITCHES TO BATTERY POWER (POTENTIALLY CHEAPER)

ON-LINE UPS ADVANTAGES

➢ ZERO SWITCHOVER TIME FROM MAIN LINE TO BATTERY POWER
➢ ALWAYS ISOLATED FROM POWER DISTURBANCES ON THE MAIN LINE
Applications of UPS:-

- UPS are used in computers, data processors, data transmitters, microwave relay station, digital controllers and nuclear reactor control system.
THANK YOU