# Real Voltage Sources

## Linear Voltage Sources

Their internal resistance is non-zero, so their voltage depends on the load connected to the terminals.

Figure 1

Plot 1 Load Line

Figure 2

### Voltage Stabilizer with Zenor Diode

Figure 3

Voltage stabilizer operates from the certain value of voltage up to certain value of current.

### Voltage Stabilizer with Transistor

Figure 4

– power deception

## Sources using Rectifiers and Transformes

* **Single Phase Transformer**  
  Figure 5 – Single Phase Transformer consists of a core (typically iron with magnetic features) forming a magnetic circuit; around it we can found a primary wiring connected to a input source of sine AC, and a secondary wiring where appears output voltage of sine AC.
  + It galvanically separates the wirings – the DC cannot pass through the SPT.
  + It operates on the Faraday Electromagnetic Law –changes of magnetic flux in the core induce the output voltage on the secondary wiring.
  + ; ;
* **Half-Wave Rectifier**  
  Figure 6
* **Bridged Full-Wave Rectifier**  
  Figure 7
* **Smoothing Capacitor**  
  Figure 8  
  The difference is called **ripple**.

## Switched Power Voltage Sources

They have much greater efficiency than linear sources, are lighter and smaller. They don’t operate continuously, but on switching regimes which switch at high frequency, so they seem to be continuous.

|  |  |  |
| --- | --- | --- |
| Property | Linear Power Sources | Switched Power Sources |
| **Efficiency** |  |  |
| **Size and Weight** | heavy | small |
| **Complexity** | not complex | more complex |
| **Noise and Ripple** | , noisy, can be small | , quiet,  is large |
| **Reliability** | high | worse |

* **AC to DC Switched Convertor**
* **Buck-Boost Convertor**

## Feedback

Put part of output back to the input in such manner, that the input is increased, we speak about **positive feedback** (leads to instability in system, is used in oscillators), in otherwise it’s **negative feedback** used to maintain stability in amplifiers.

# Operational Amplifier

## Non-inverting Amplifier

Figure 1

The polarity of input voltage is the same as the polarity of output voltage. It has high input resistance

Figure 2

Amplification factor is greater than one. When we replace resistor by the short, we get the **voltage follower** – output voltage is the same as input voltage.

## Real Operational Amplifier

Figure 3

### Transfer Voltage Characteristic

Figure 4 – non-inverting amplifier

We supply our amplifier by the symmetrical source and with a common ground.

For the **rail to rail** amplifiers, it holds true: . In all real cases, the linear amplifier is only about .