Block 21 — Op-Amp Basics

Student Group

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Learning objectives

> After this 90-minute block, you can
>
> - ...

Preparation at Home

Well, again

- read through the present chapter and write down anything you did not understand.
- Also here, there are some clips for more clarification under 'Embedded resources' (check the text above/below, sometimes only part of the clip is interesting).

For checking your understanding please do the following exercises:

- ...

90-minute plan

1. Warm-up (x min):
    1. ....
2. Core concepts & derivations (x min):
    1. ...
3. Practice (x min): ...
4. Wrap-up (x min): Summary box; common pitfalls checklist.

Conceptual overview

> 1. ...

Core content

> Fig. 1: undistorted signal
>
> hallo.mp3

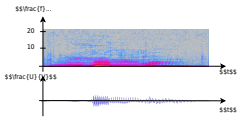
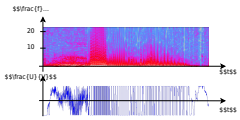


Fig. 2: overdriven signal

hallo_verzerrt.mp3



Introductory example

Acoustic amplifiers, such as those found in mobile phones, laptops, or hi-fi systems, often exhibit an unpleasant characteristic when heavily amplified: the previously undistorted signal is no longer passed on as usual, but clatters. It is distorted in such a way that it no longer sounds pleasant.

For this purpose, you will find an acoustic example with pictures in figure 1 and figure 2 respectively. The bottom of each image shows the time course of the voltage output to a loudspeaker (x-axis: time, y-axis: frequency). The upper picture has three dimensions: It shows in color intensity which frequencies are used at which time. The frequencies in grey areas are not used. If a frequency is shown in red at one point in time, it has a relatively large amplitude.

It can be seen that the distorted signal has large amplitudes in the time course of the voltage as well as a wide distribution of frequencies (= a broad spectrum). The high frequencies in particular can promote wear of the diaphragm in loudspeakers.

The signal distortion is due to the design of the amplifier, which can only output the maximum possible voltage and otherwise clipping. The structure of an acoustic amplifier is similar to that of a feedback operational amplifier, as seen in the simulation.

Acoustic amplifiers are usually constructed like operational amplifiers, which will be considered

> in the following chapters.

Common pitfalls

- …

Exercises

Worked examples

…

Embedded resources

What is an operational amplifier?