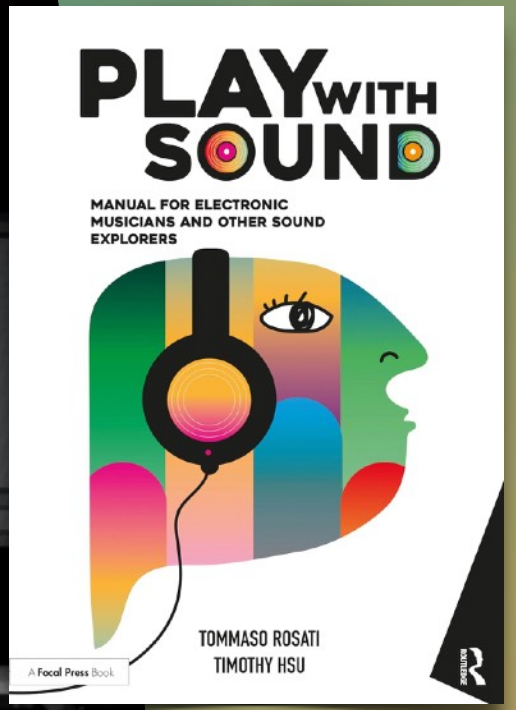
TOMMASO ROSATI
SOUND ART

FILTERS and EQ
(+ DERIVATIVE EFFECTS)

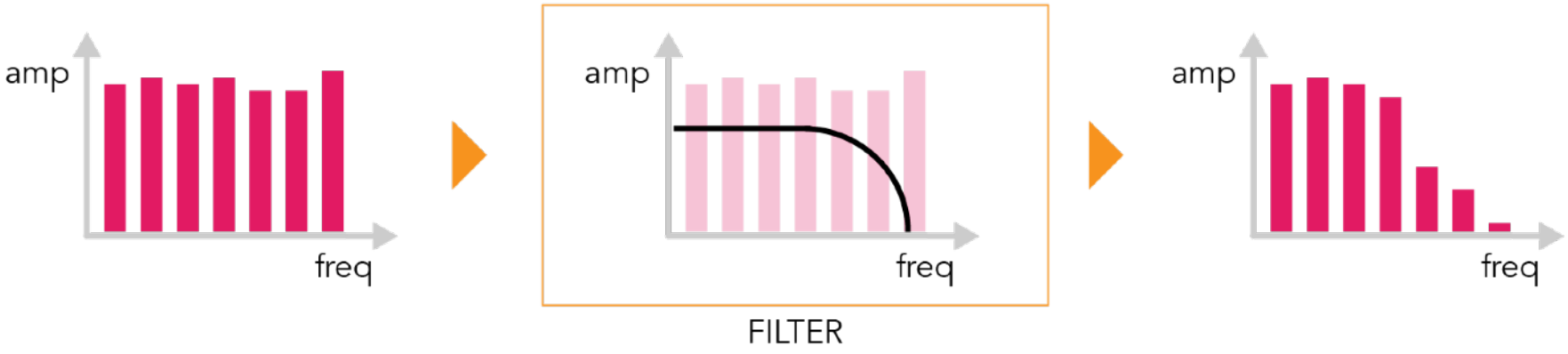
FILTERS
WAH-WAH
PHASER

THE BOOK IS NOW AVAILABLE!



Filter

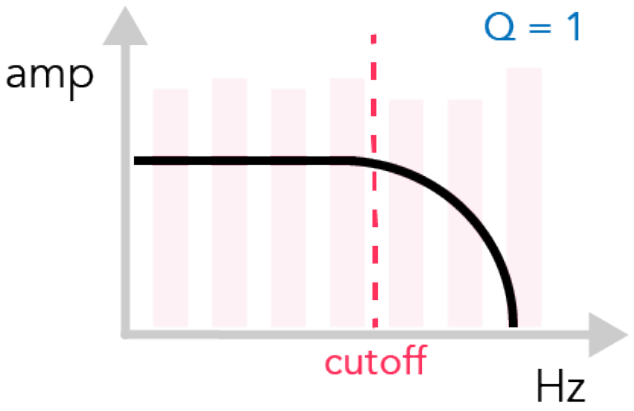
A **filter** is a device that attenuates the amplitude* of certain frequencies in a sound. With amplification and gain incorporated with filters, it is also possible to **emphasize** or boost certain frequencies. *.



* and, consequently, alters the phase

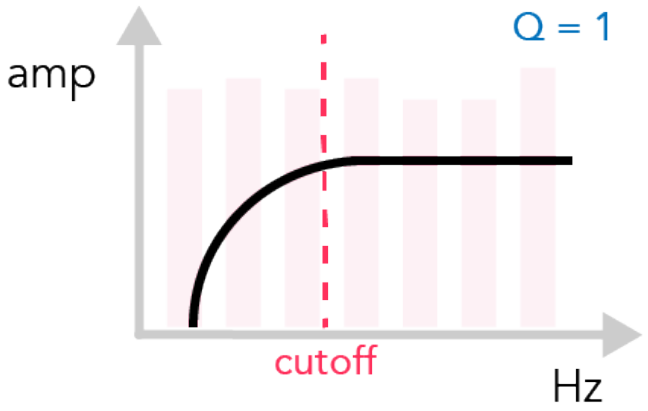
Main Filters

Low-Pass FILTER



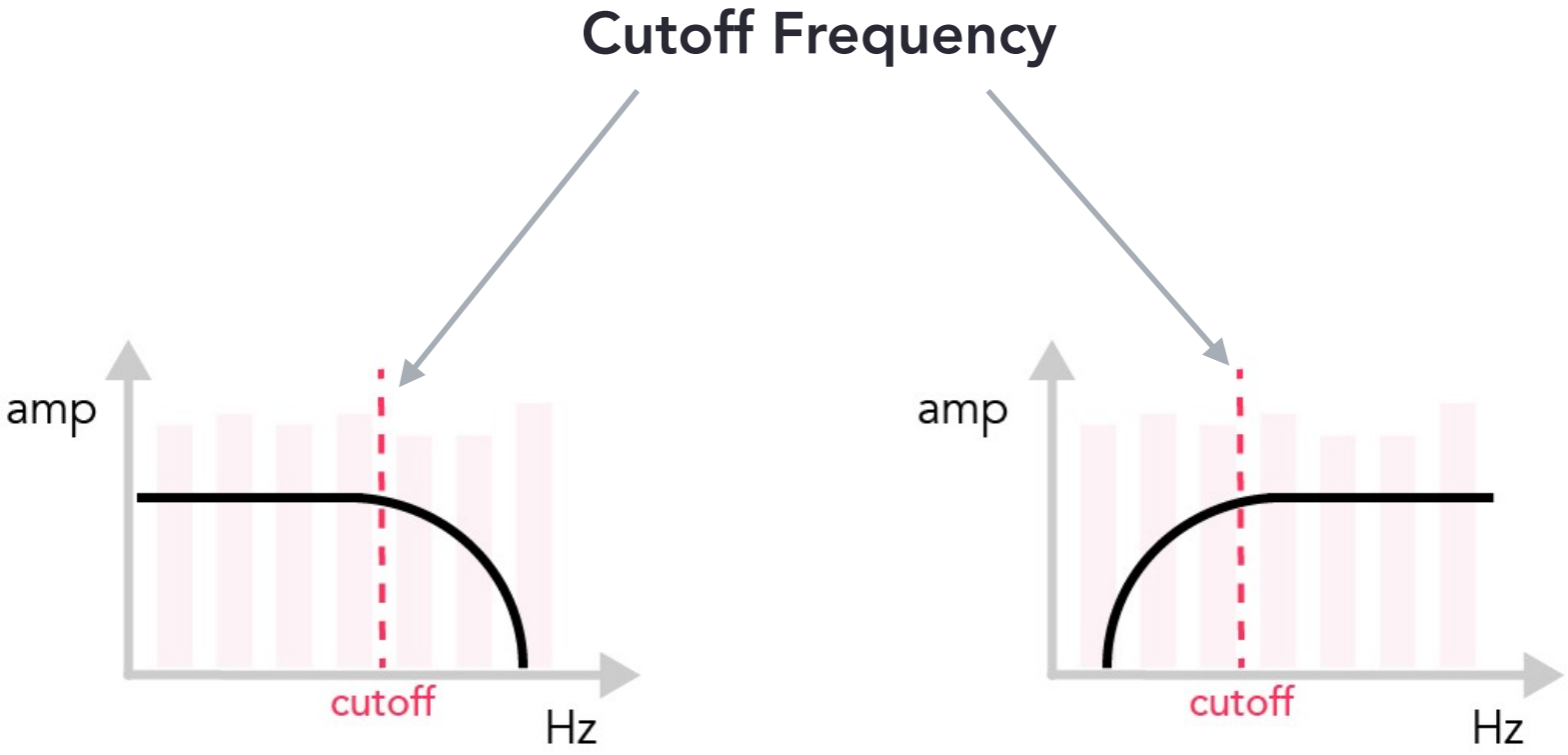
Attenuates frequencies above the cut-off frequency while maintaining those below

High-Pass FILTER



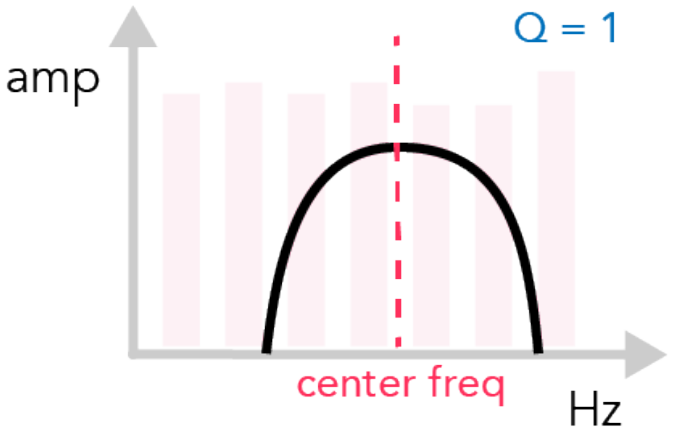
Attenuates frequencies below the cut-off frequency while maintaining those above it

Parameters



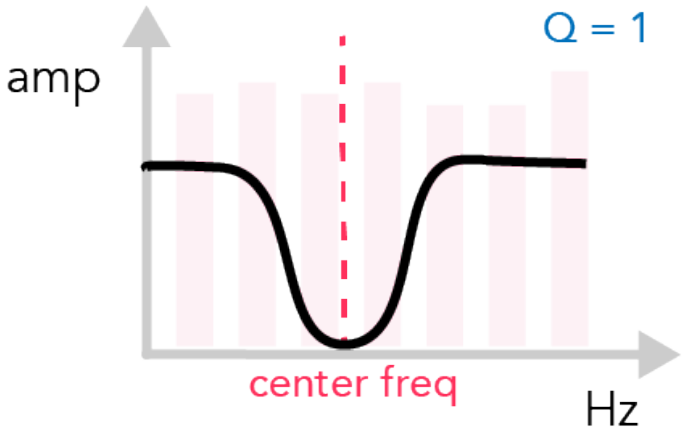
The frequency threshold, in hertz, where the filter essentially activates

Band-Pass FILTER



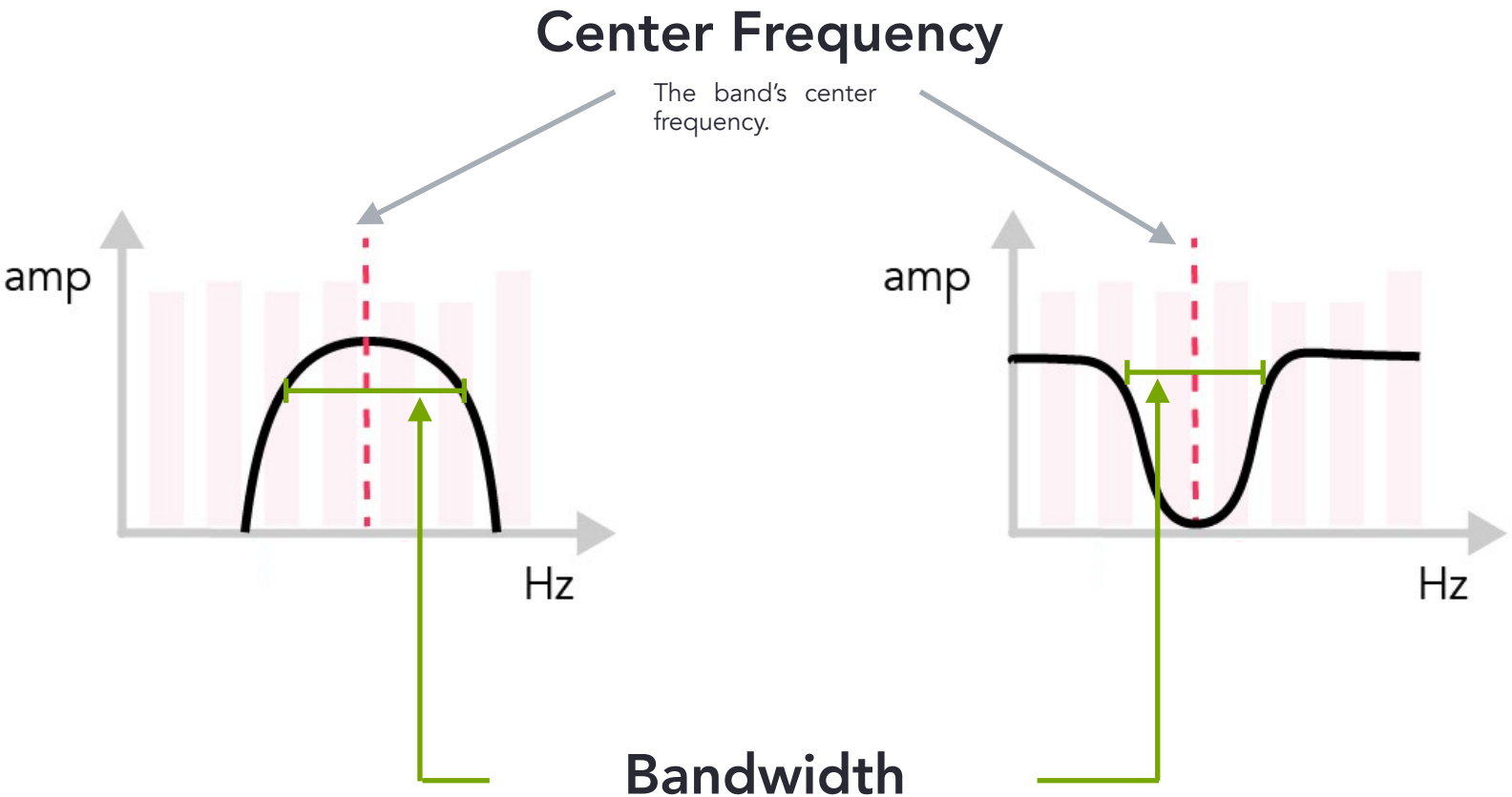
It passes frequencies within the frequency range of the chosen band.

Notch FILTER

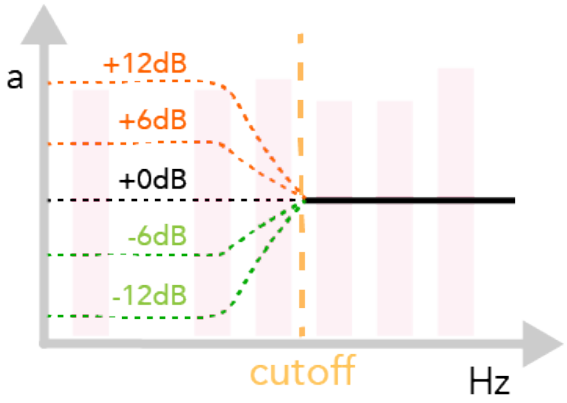


Removes frequencies within the frequency range of the chosen band.

Parameters

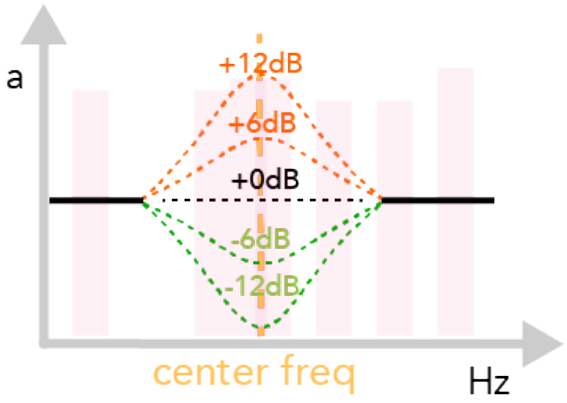

Center Frequency
The band's center frequency.
amp
Hz
amp
Hz
Bandwidth
How wide the frequency band is, in hertz.

Low-Shelf FILTER



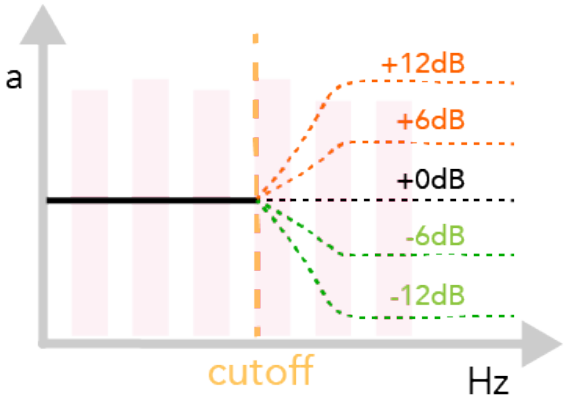
Emphasizes or attenuates frequencies below the cut-off frequency

Bell FILTER



Emphasizes or attenuates a particular frequency band

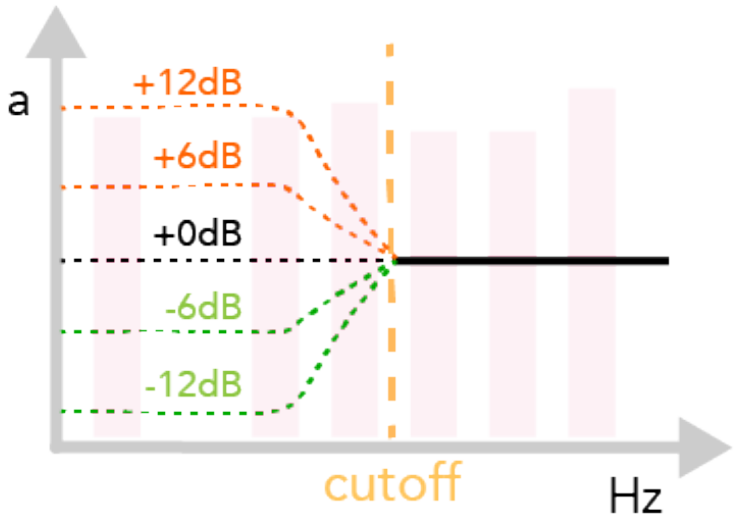
High-Shelf FILTER



Emphasizes or attenuates frequencies above the cut-off frequency

Parameters

Gain

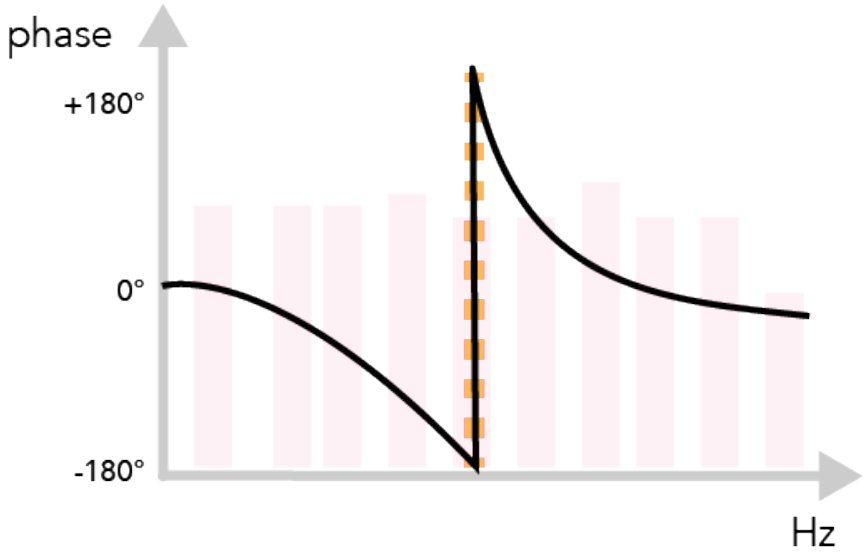


Gain is the the amplitude scaling factor that controls how much the shelf filters emphasize or attenuate the signal within the EQ's response. It is measured in dB.

All-Pass FILTER

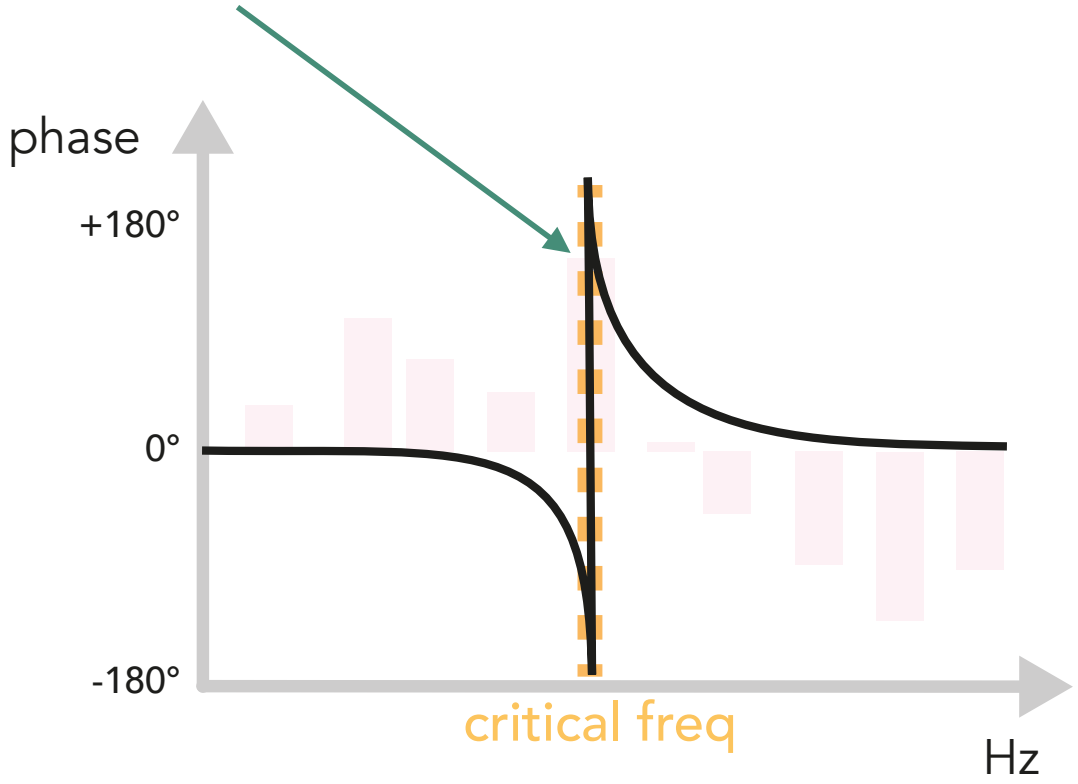
The **All-pass** filter is a filter that passes all frequencies, not changing the amplitude. This filter can significantly change the phase though.

This comes in handy when all-pass filters are used in conjunction with other copies of the same sound, causing boosts, attenuations, or even cancellations of certain frequencies of our sound.

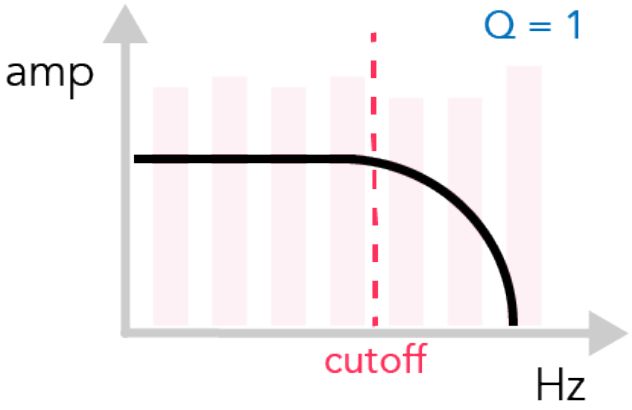


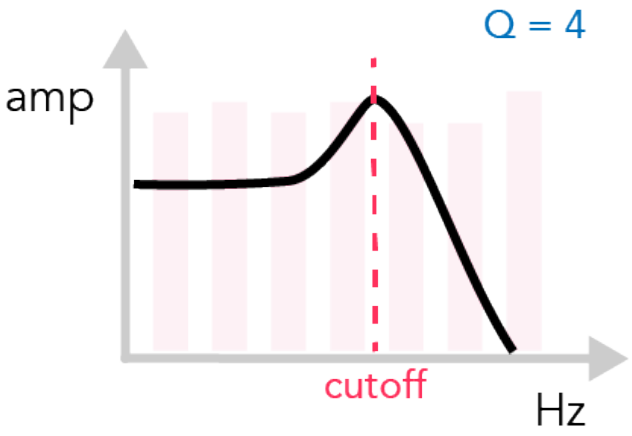
Parameters

Critical frequency can be set to control phase. An all-pass filter does not change all the phases of the spectrum that make up our sound in the same way. The phase of the frequencies surrounding the critical frequencies are most affected by the all-pass filter. As we move further away from the critical frequency, the phase response shifts less.

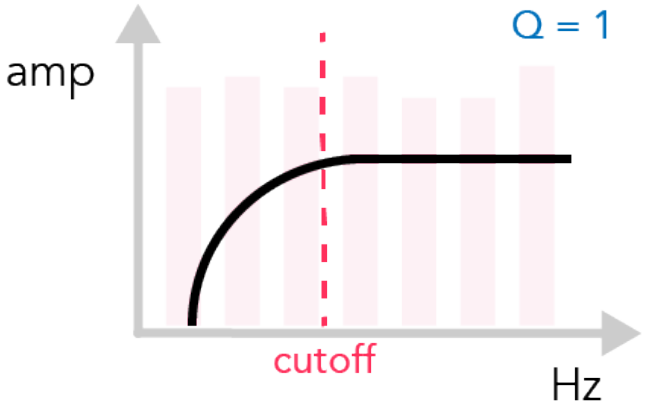


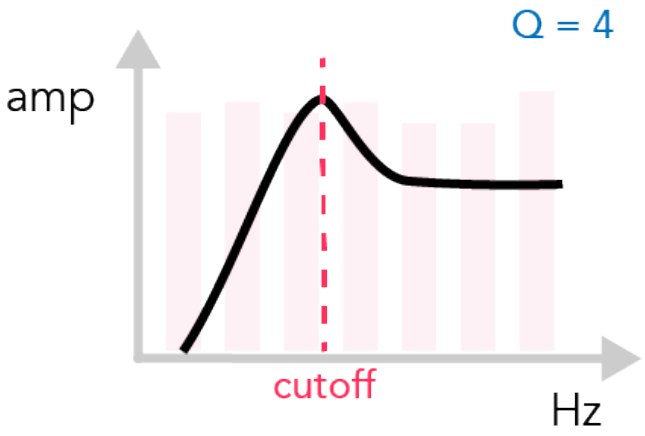
Low-Pass FILTER



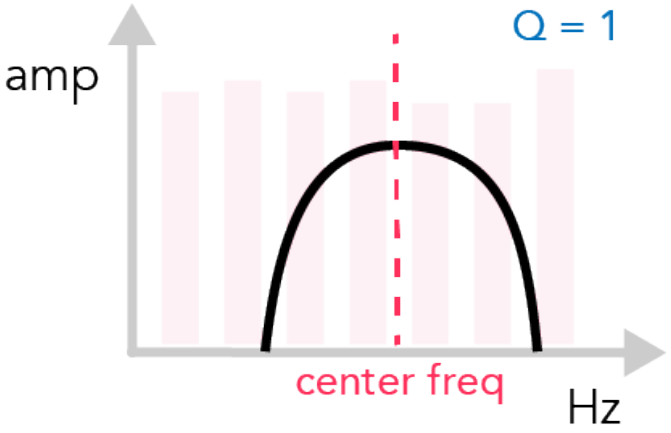


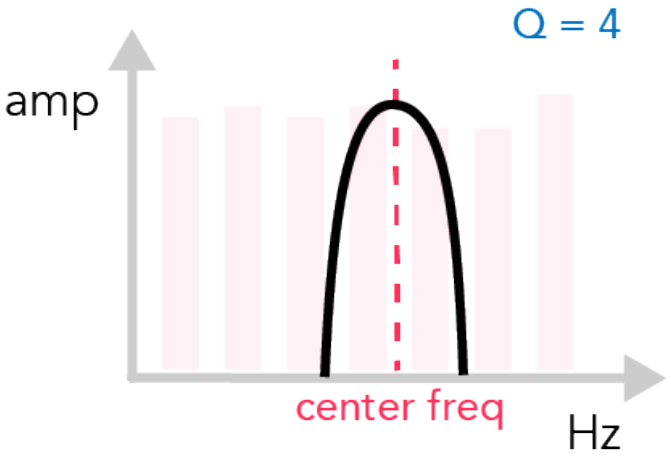
High-Pass FILTER



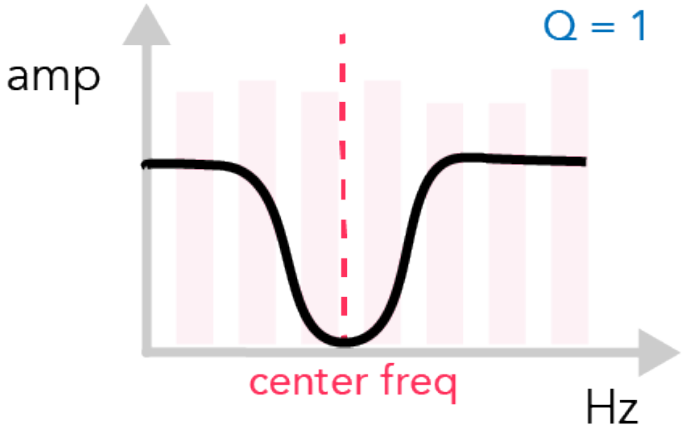


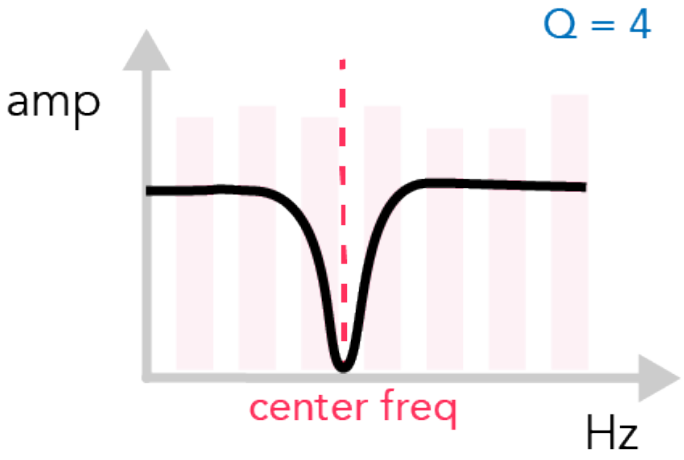
Band-Pass FILTER



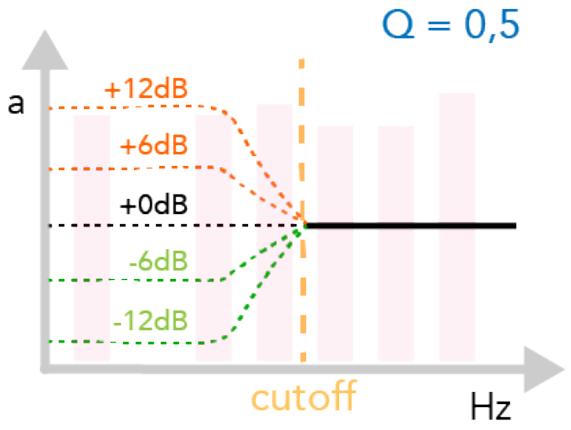


Notch FILTER

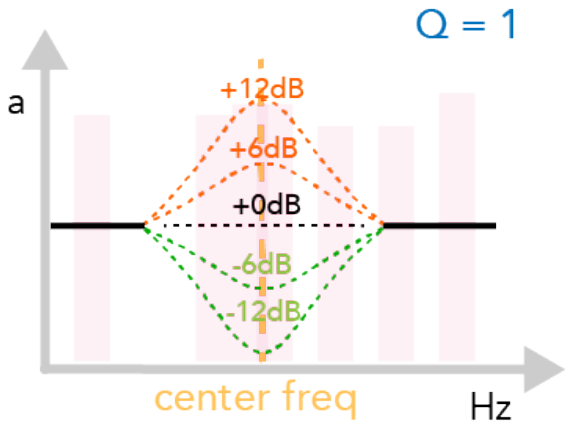




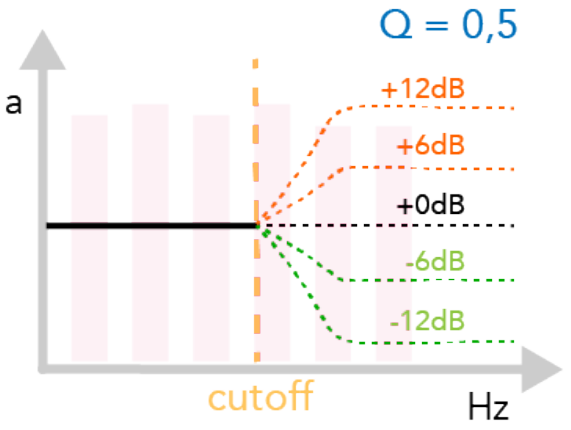
Low-Shelf FILTER

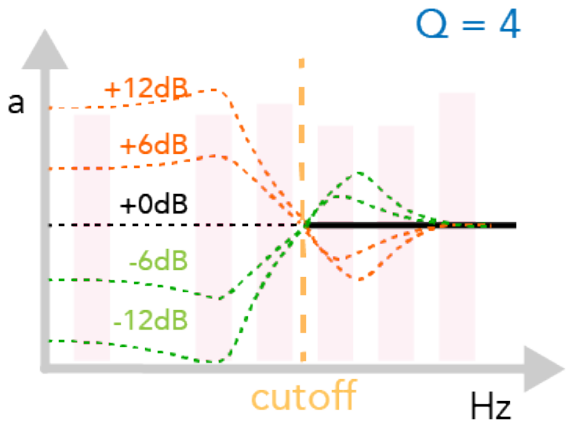


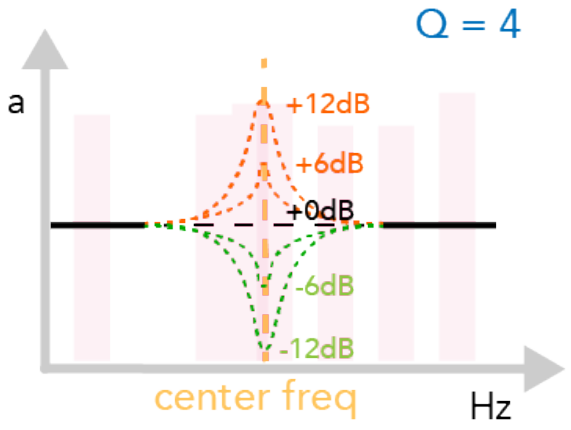
Bell FILTER

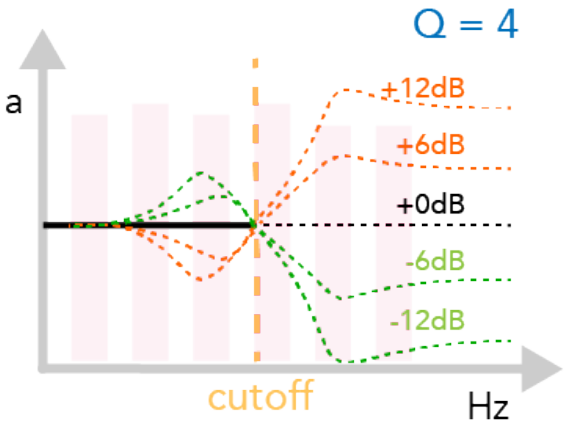


High-Shelf FILTER

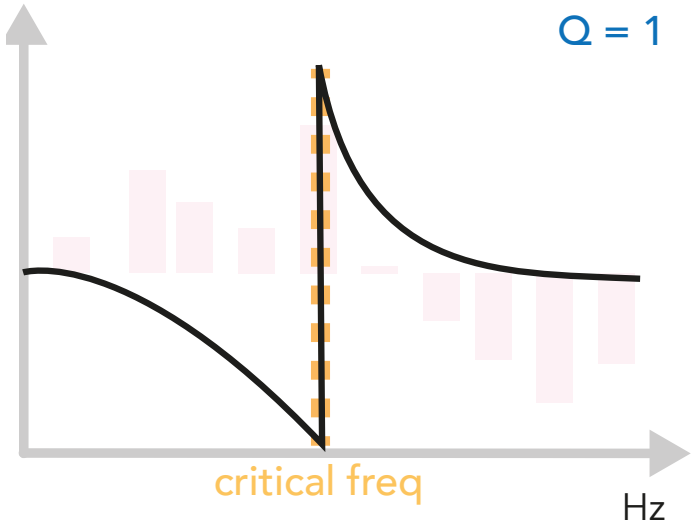


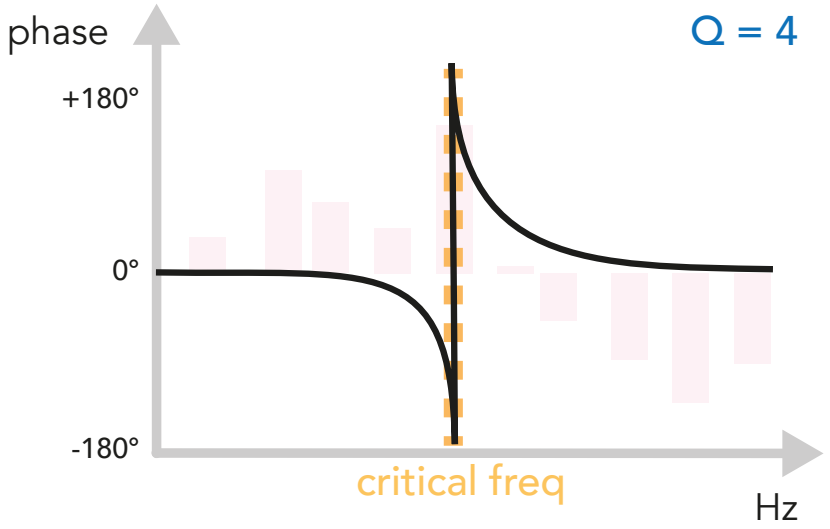






Q: in this case represents the slope of the phase curve and consequently the amplitude of the band subject to phase inversion, i.e. the band in which the filter has the greatest effect





Filters order:
How steep is the filter?

First order filters: attenuation of 6 dB per Octave

1nd

LPF example:
Cutoff: 1,000 Hz
Input sound: sine wave 4,000 Hz
Result: sine wave 4,000 Hz halved in amplitude (-6 dB)

HPF example:
Cutoff: 1,000 Hz
Input sound: sine wave 250 Hz
Result: sine wave 250 Hz halved in amplitude (-6 dB)

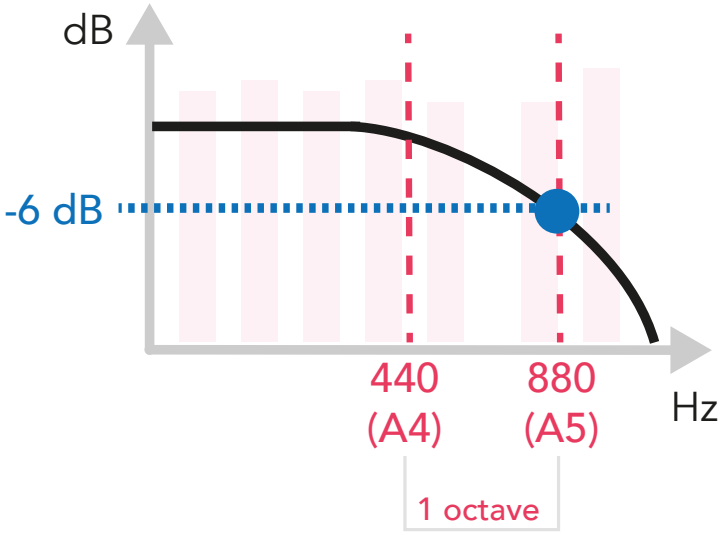
Second order filters: attenuation of 12 dB per Octave

2nd

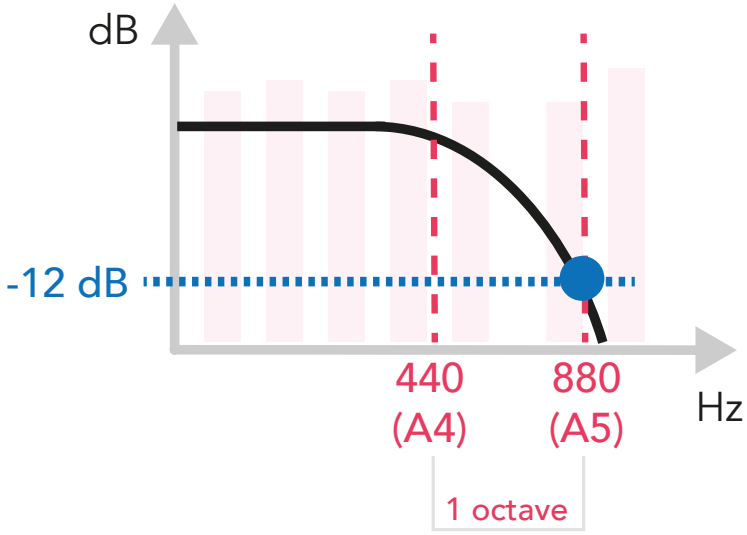
LPF example:
Cutoff: 1,000 Hz
Input sound: sine wave 8,000 Hz
Result: sine wave 8,000 Hz at 1/4 of the amplitude (-12 dB)

HPF example:
Cutoff: 1,000 Hz
Input sound: sine wave 250 Hz
Result: sine wave 250 Hz at 1/4 of the amplitude (-12 dB)

1st ORDER = 6 dB per Octave



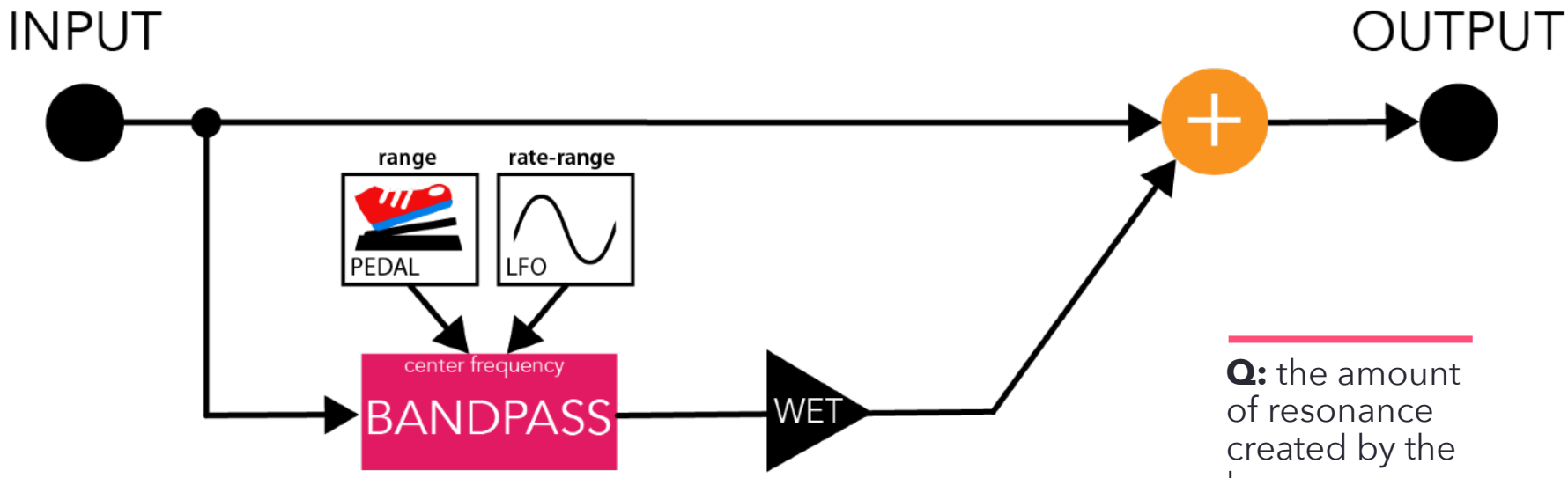
2nd ORDER =12 dB per Octave



To obtain filters **higher than second-order** we can connect in series several first or second-order filters.

Wah-wah

If I rhythmically vary the center frequency of a band-pass filter with a high Q value, I get an effect the Wah-wah effect. Changing the resulting center frequency causes a kind of "mewing" of our input sound, precisely achieving the onomatopoeic name, wah-wah. Usually, we use a dedicated pedal to modulate this effect, but you can also automate the changes with an LFO, resulting in an auto-wah.



Q: the amount of resonance created by the lowpass

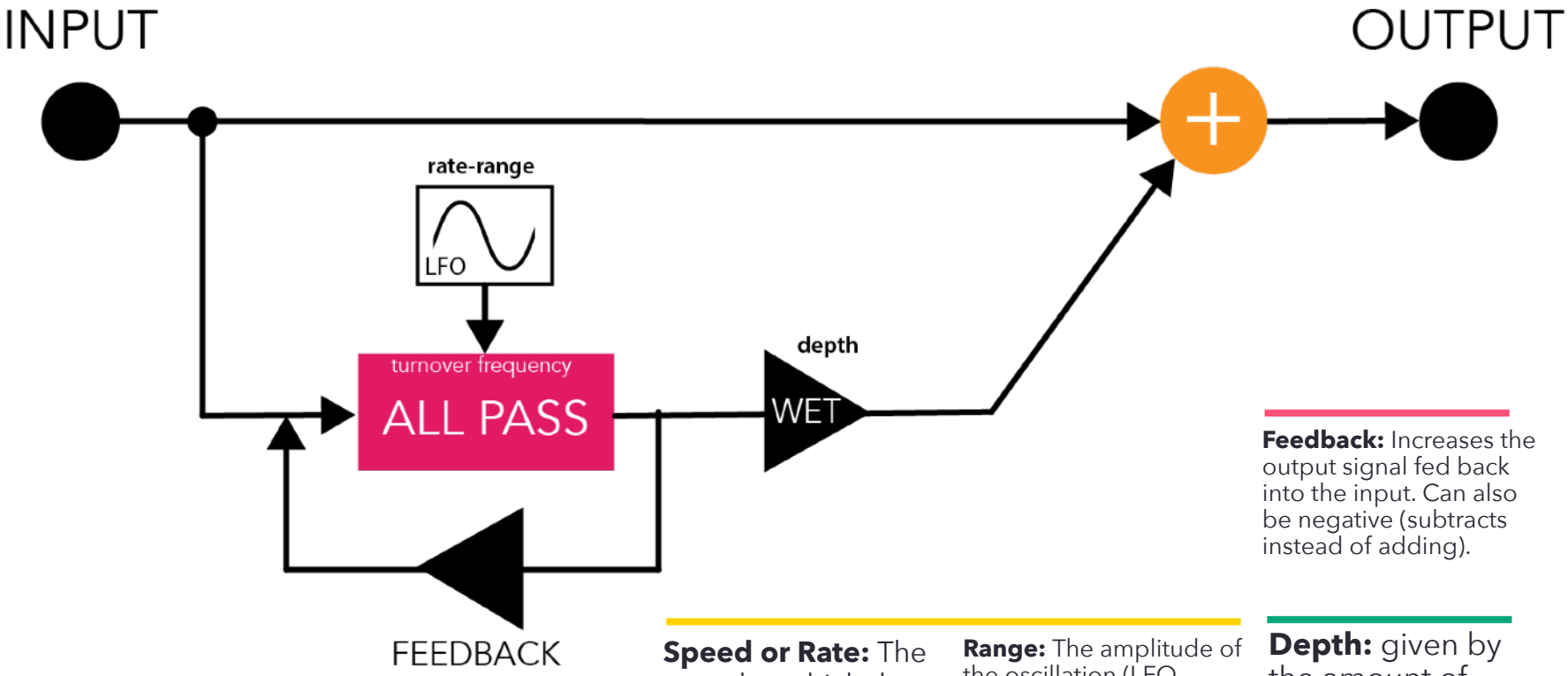
Speed or Rate: The speed at which the center frequency varies (LFO speed)

Range: The frequency range on which the pedal or LFO acts

WET: amount of processed sound that I add to the original

Phaser

We can control the critical frequency of an all-pass filter continuously with an **LFO**. As this critical frequency sweeps up and down with a copied signal, phase cancellations will occur at particular frequencies. Because the LFO controls the sweep, the effect is a sort of “negative” glissando, where an absence of energy in a frequency band glisses higher and lower. This effect is known as the **Phaser**.

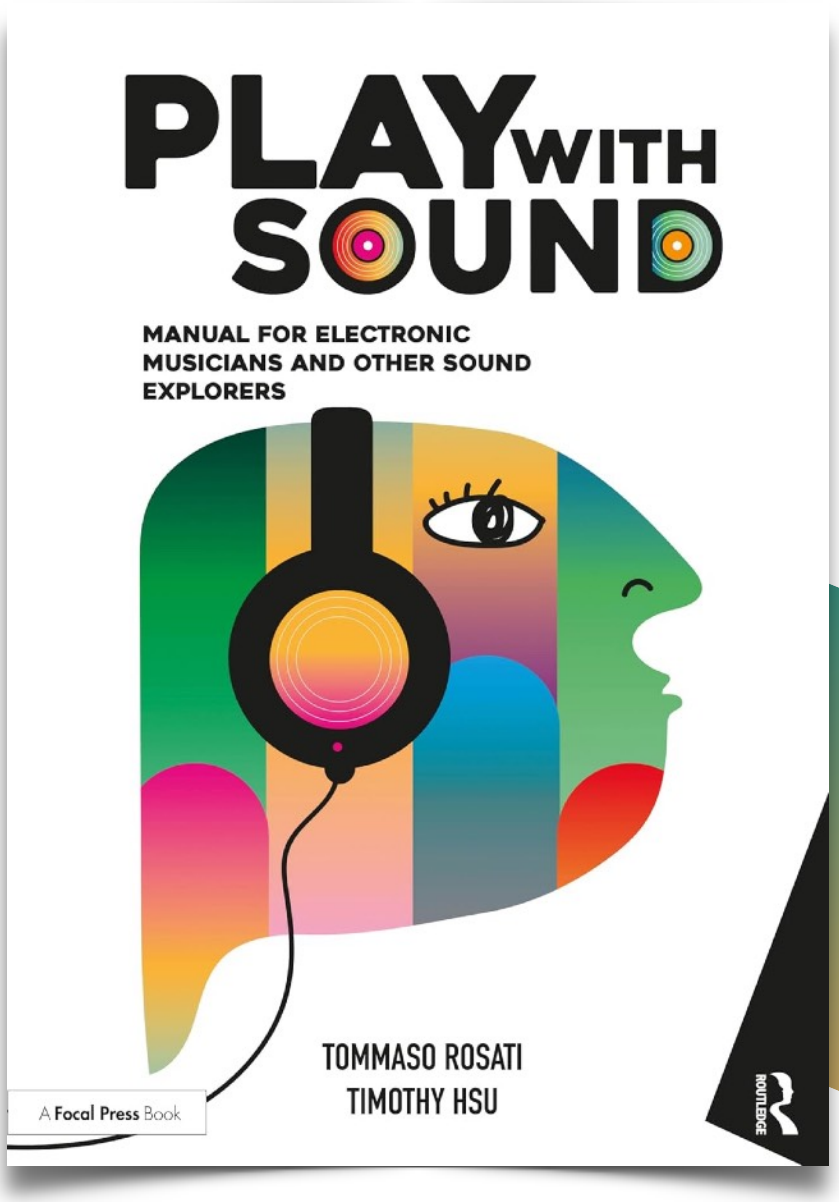


Feedback: Increases the output signal fed back into the input. Can also be negative (subtracts instead of adding).

Speed or Rate: The speed at which the turnover frequency varies (LFO speed)

Range: The amplitude of the oscillation (LFO amplitude) that controls the range of variation of the turnover frequency

Depth: given by the amount of delayed sound I add to the original



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