Software 2 WS 2016 #2

Chikashi Miyama

Phase Distortion Synthese

Phase Distortion Synthese

- F: Wer ist der Erfinder von PD (Phase Distortion Synthese) ?

Phase Distortion Synthese

- A: Casio corporation

Produkt von Casio

https://www.youtube.com/watch?v=5HwGhIgnrFw

… und Wer ist der Erfinder von FM?

Phase Distortion Synthese

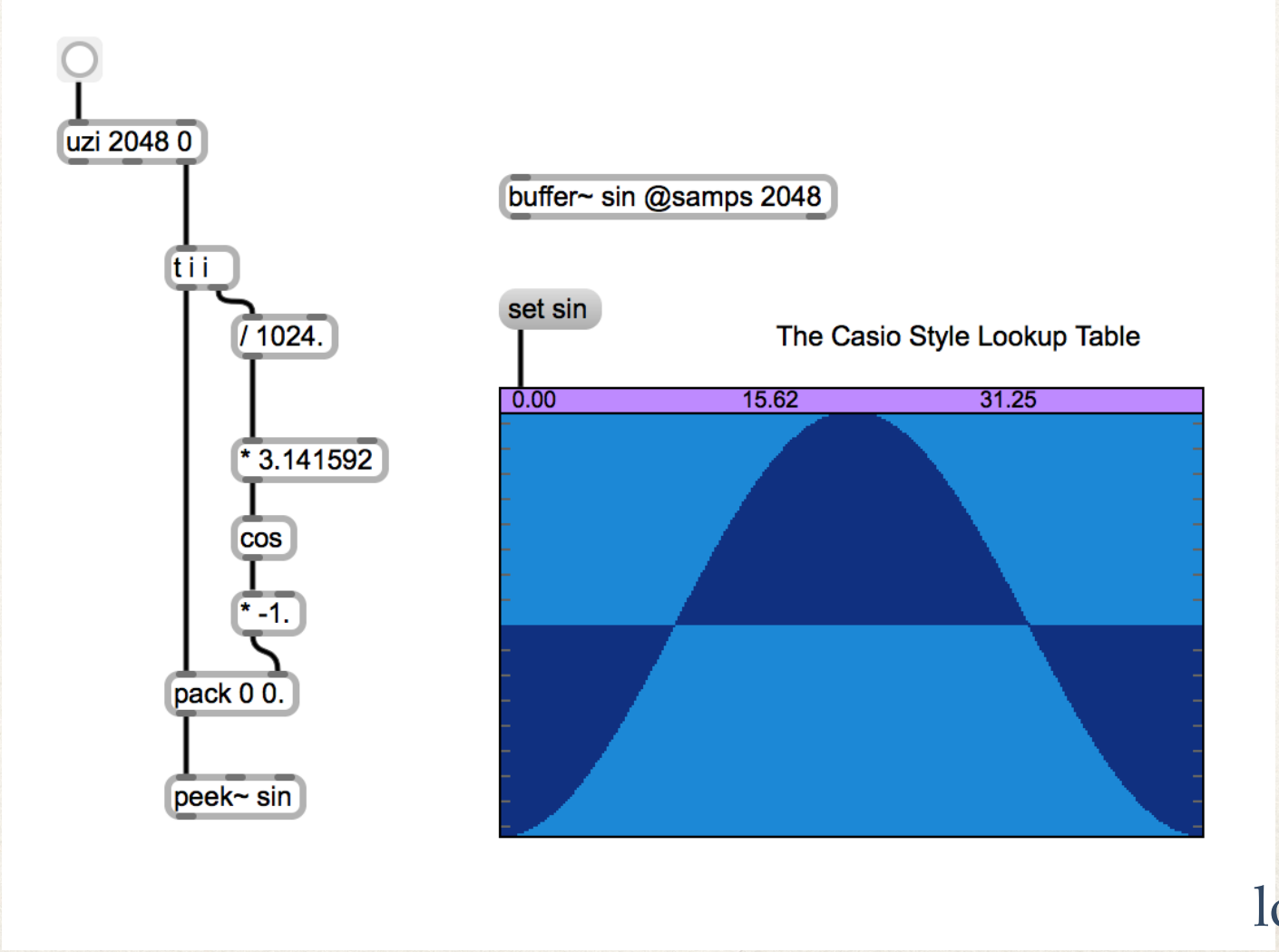
- F: Wie funktioniert die PDS?

Phase Distortion Synthese

- A:

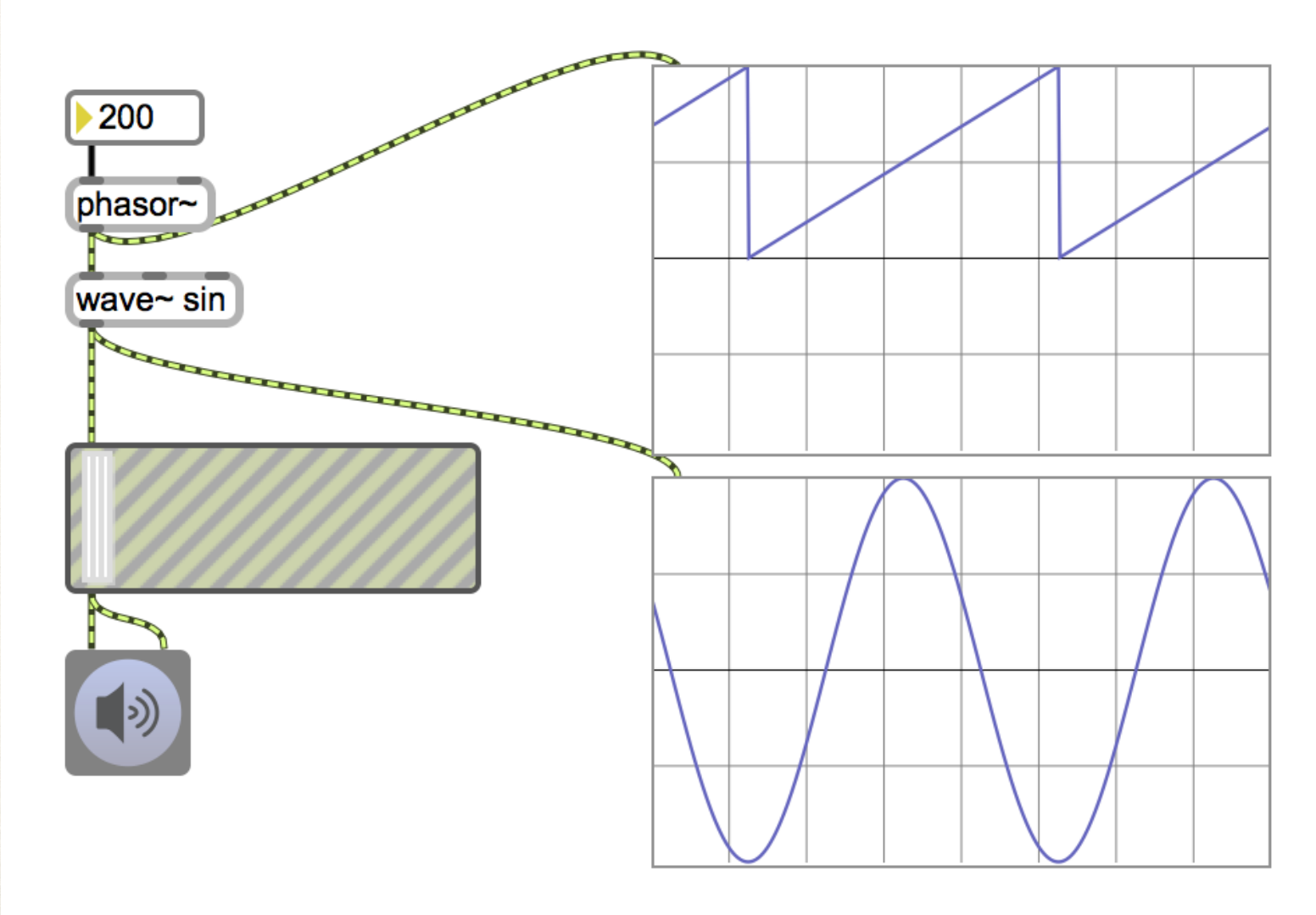
*PD synthesis uses a **sine wave table-lookup oscillator** in which the rate of scanning through the oscillator varies over the cycle.*

Sine Wave Lookup Oscillator



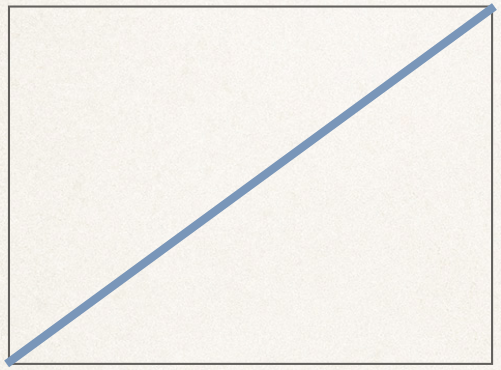
lookup.maxmsp

Sine Wave Lookup Oscillator



Scanning Phasor

Phasor



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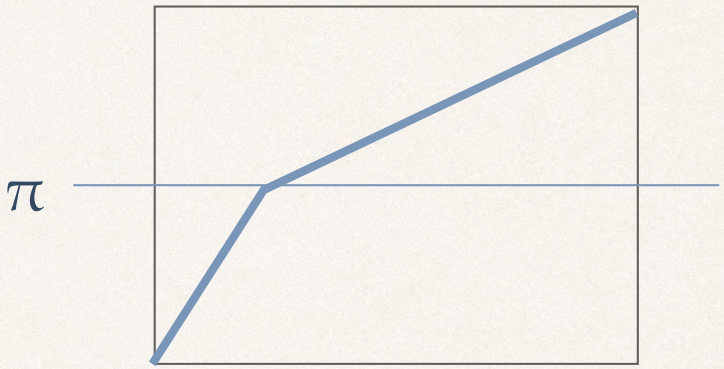
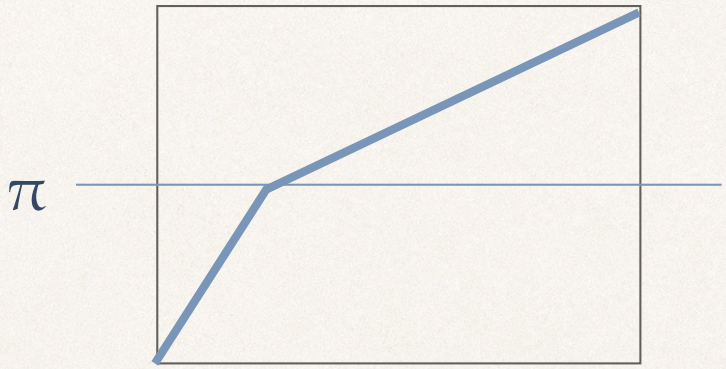


?

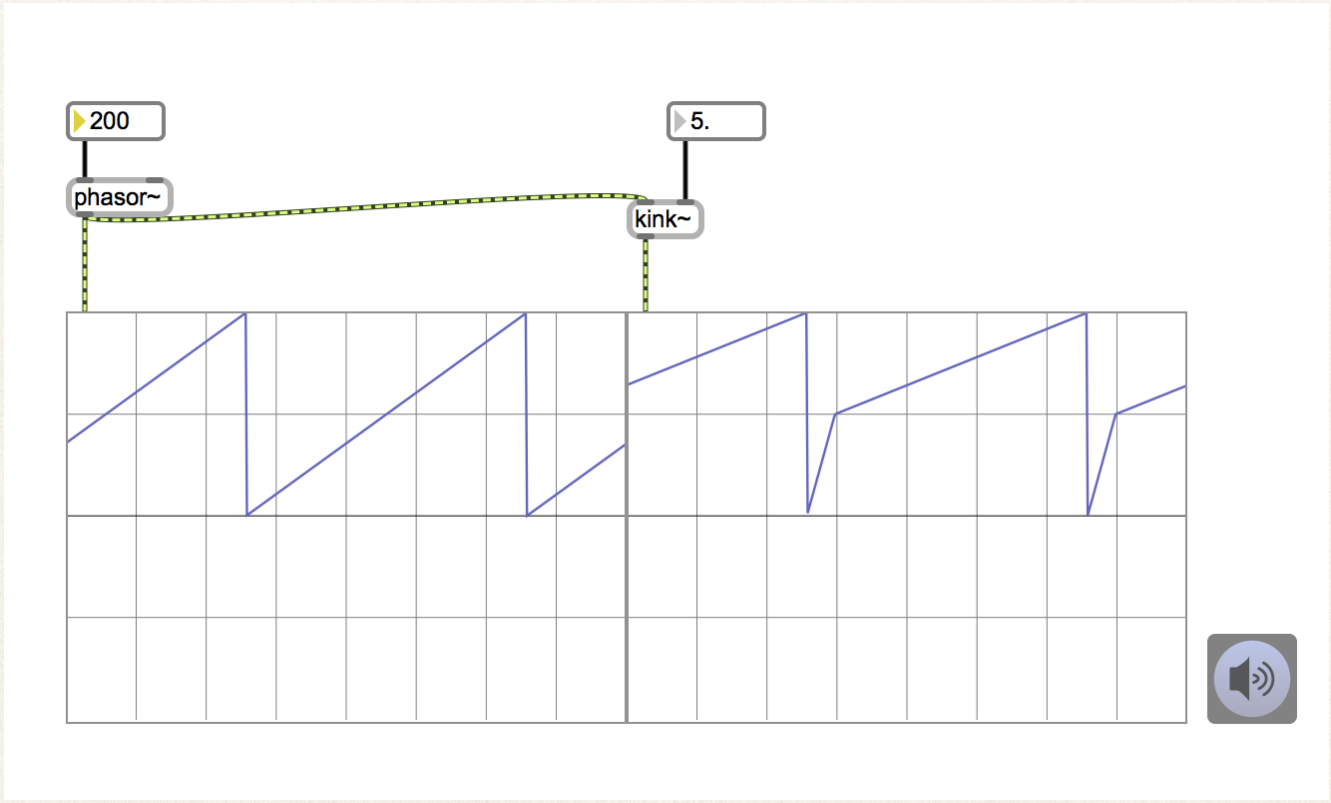
Distorted Phasor in Max

Scanning Phasor



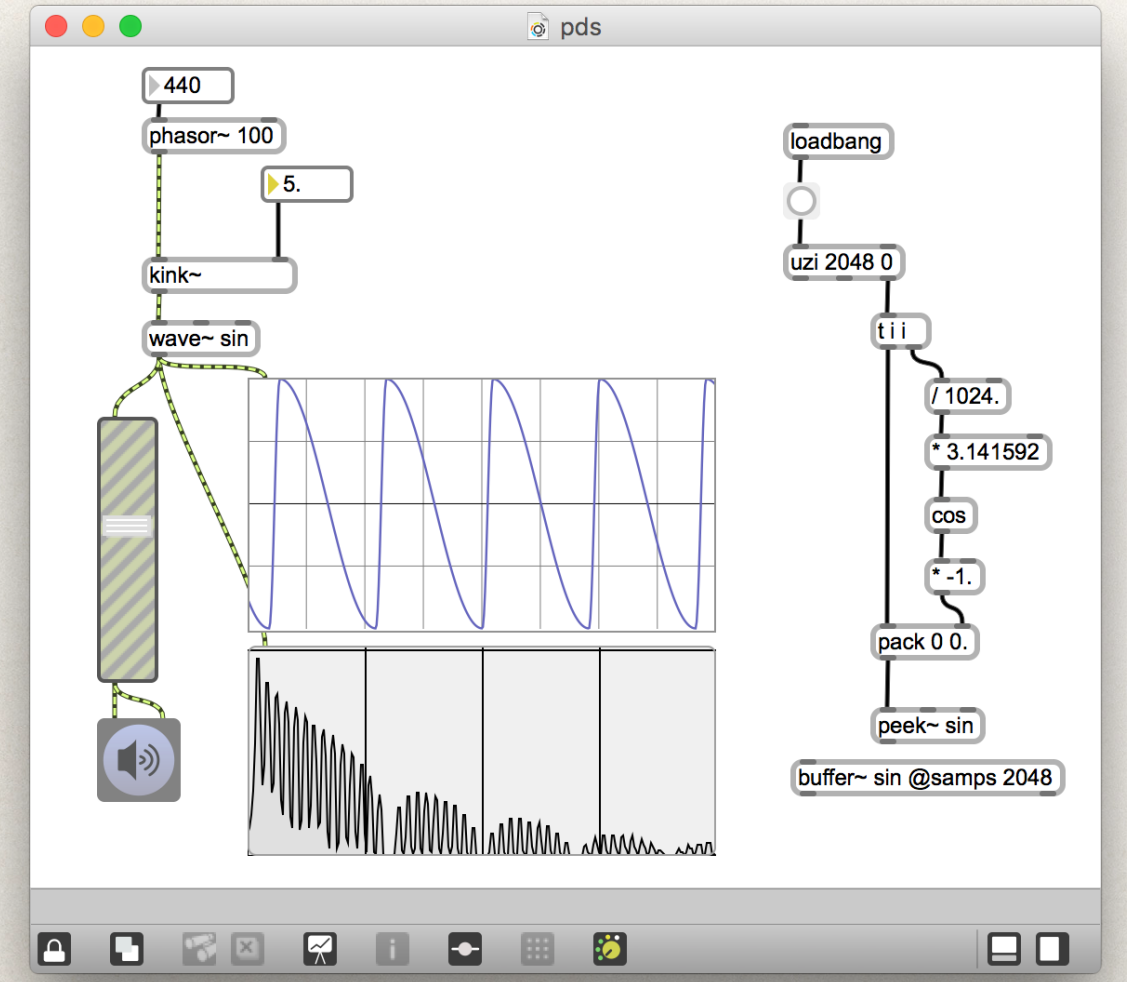
Wie kann man diesen Phasor in Max programmieren?

Distorted Phasor in Max



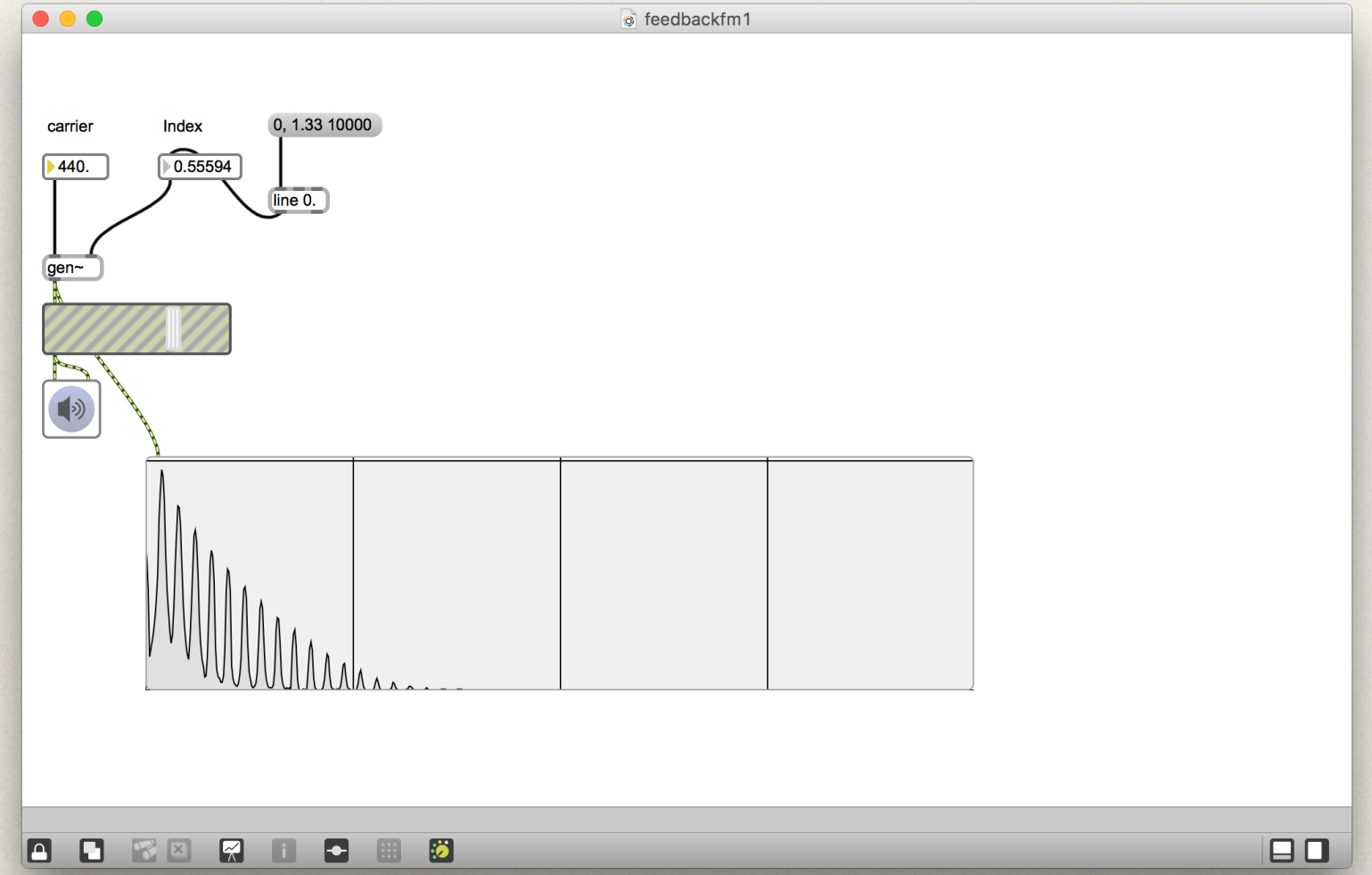
kink.maxmsp

Phase Distortion Synthese



pds.maxpat

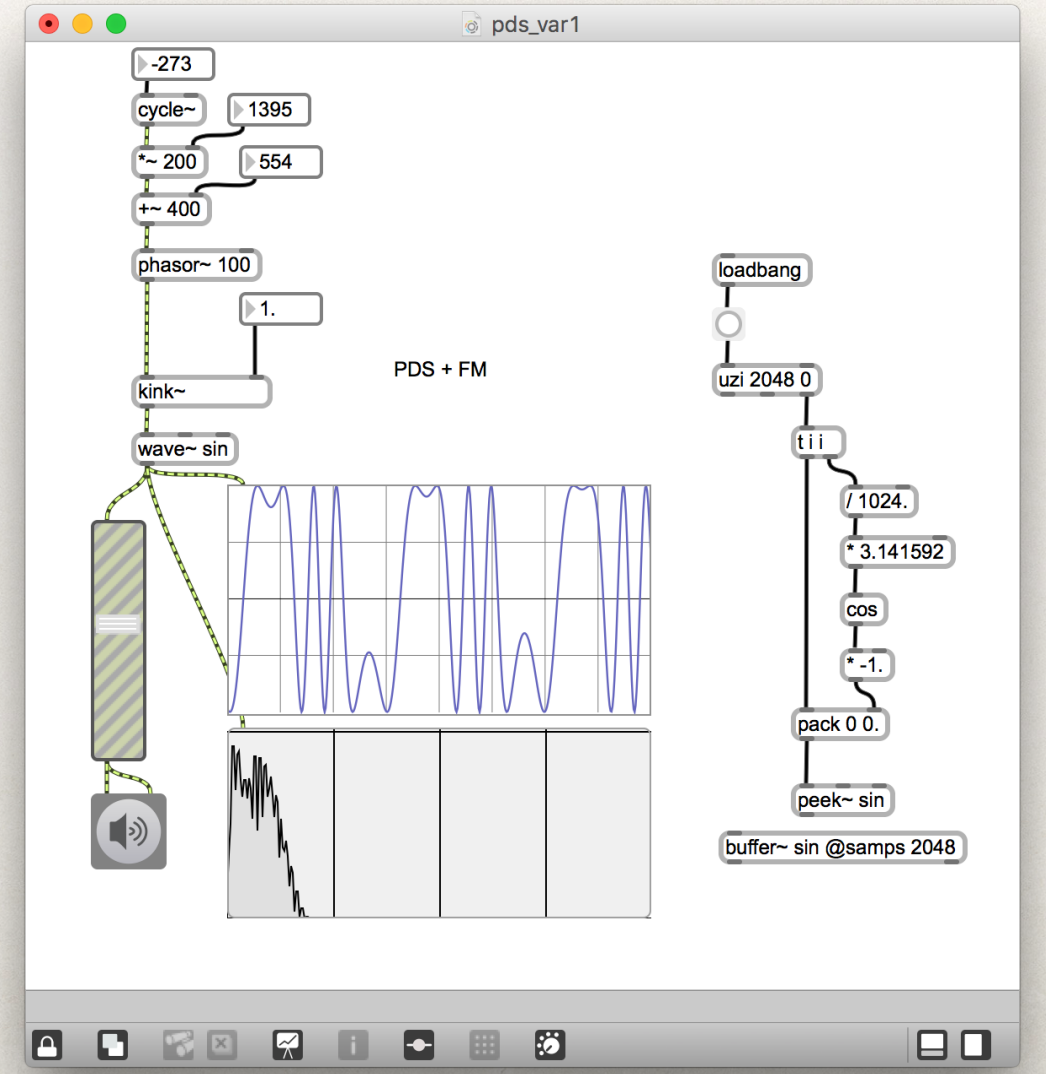
Feedback FM und PDS



feedbackfm.maxmsp

Weitere Entwicklungsmöglichkeiten 1

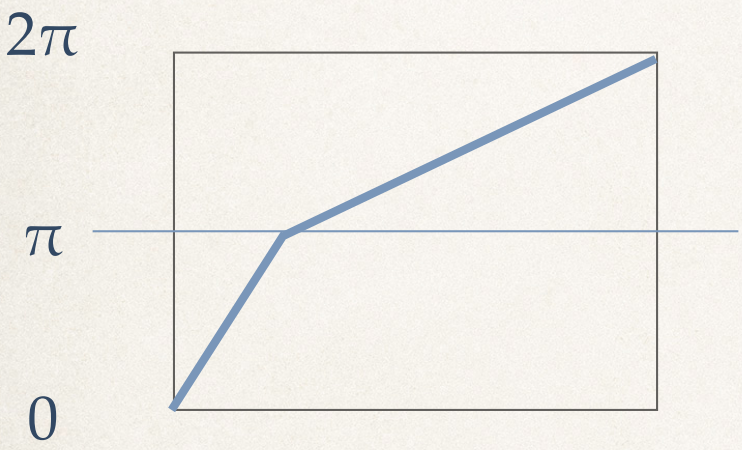
PDS + FM

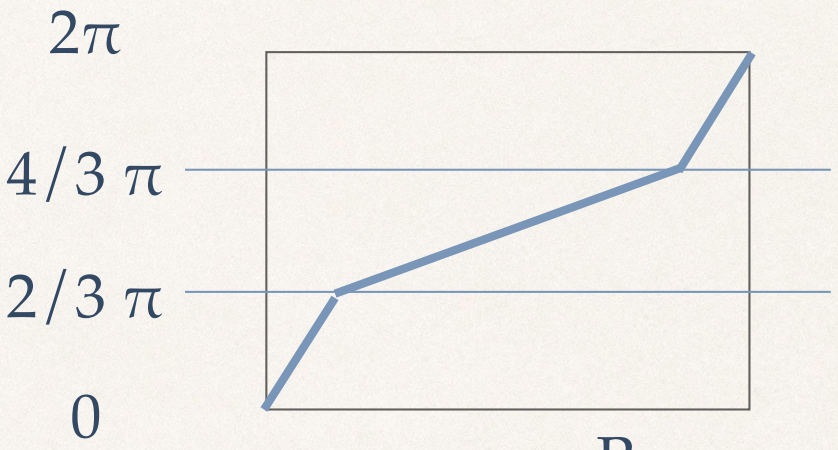


pds_fm.maxmsp

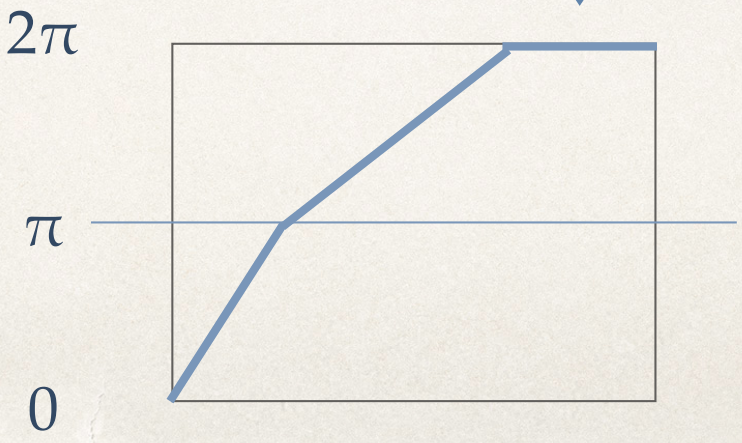
Weitere Entwicklungsmöglichkeiten 2

PDS + zwei Gelenke

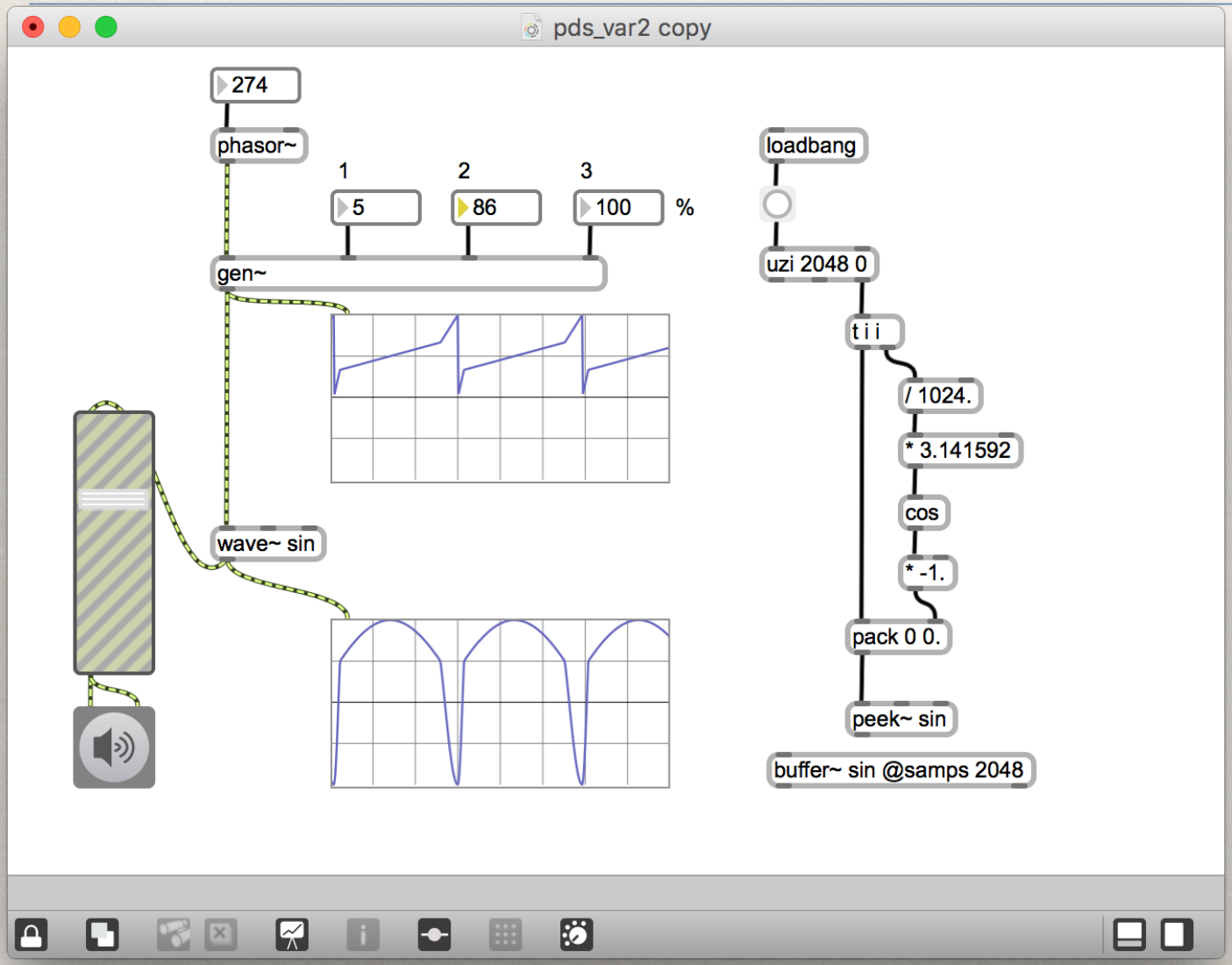




Pause



Weitere Entwicklungsmöglichkeiten 2



pds_morejoints.maxpat

Das Patent

United States Patent **4,658,691**
Ishibashi, deceased **April 21, 1987**

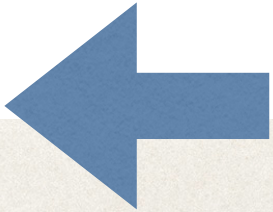
**Please see images for: (Certificate of Correction) **

Electronic musical instrument

Abstract

An electronic musical instrument includes circuitry for modifying an ordinary address signal which changes at a uniform rate over one cycle of a waveform, into a modified address signal whose rate varies in one cycle of the waveform by the use of a modification signal. The modified address signal accesses a storage device such as a ROM in which waveform data is stored, thereby producing the modified waveform data from the storage device. The modification signal is obtained from the ordinary address signal through a predetermined logic circuit.

Inventors: **Ishibashi, deceased; Masanori** (late of Oume, **JP**)
Assignee: **Casio Computer Co., Ltd.** (Tokyo, **JP**)
Family ID: **26524196**
Appl. No.: **06/788,669**
Filed: **October 17, 1985**



Waveshaping

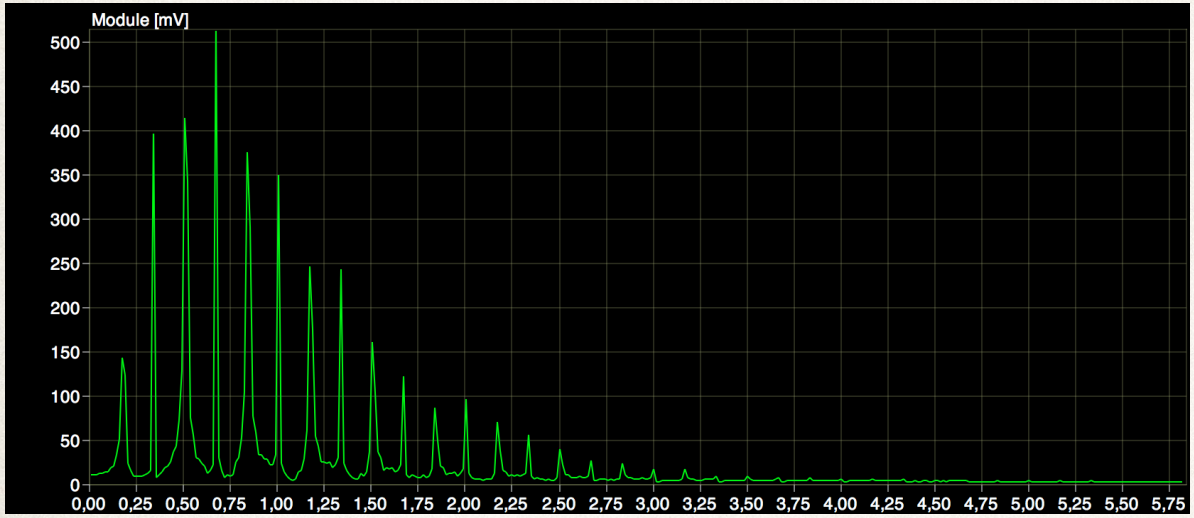
Wellenform Synthese

- F: Was sind die Vorteile und die Nachteile von Wellenform Synthese?

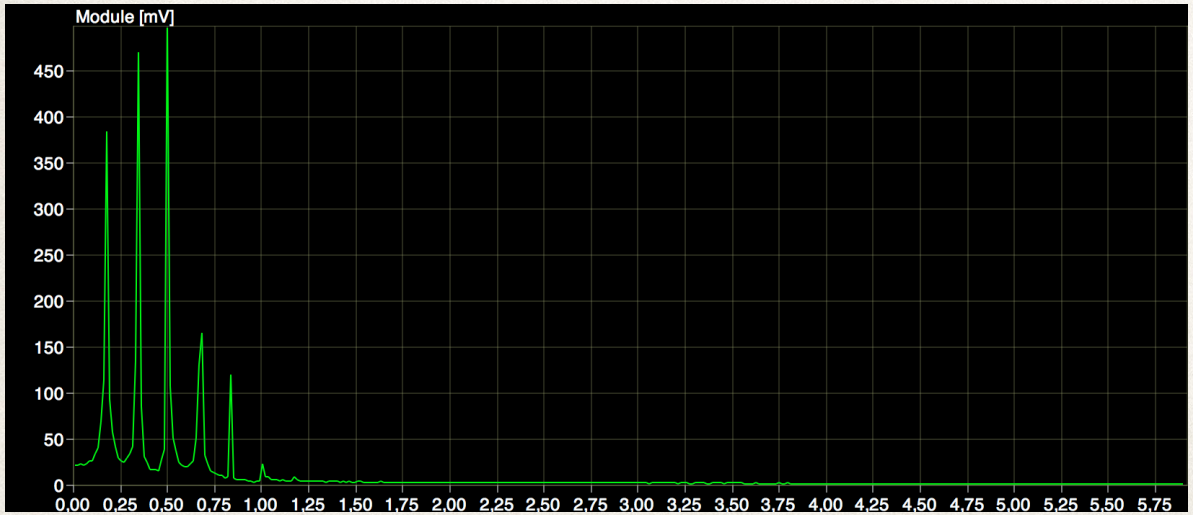
Wellenform Synthese

- A:
  - Vorteil : nicht CPU aufwendig.
  - Nachteil: klingt unnatürlich
    - zu stabil (wegen der Wiederholung)
    - **immer gleiche Klangfarbe**

Spektrum von Posaune



forte

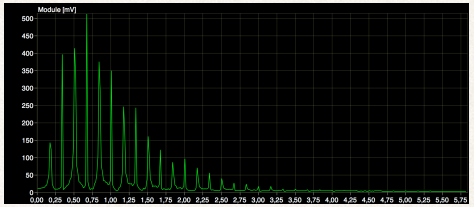


piano

Natürlicher Klang

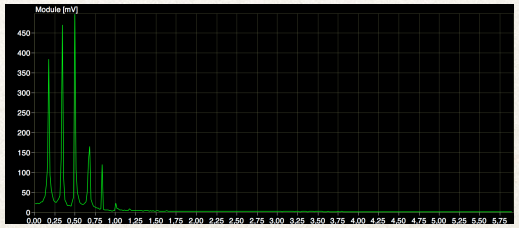
- Die Klangfarbe ist abhängig von der Lautstärke

ff



Lautstärke

Klangfarbe



pp

Imitation der Natürlichkeit

- F: Wie kann man die Natürlichkeit der akustischen Instrumente imitieren?

Imitation der Natürlichkeit

- A: Mehrere Samples

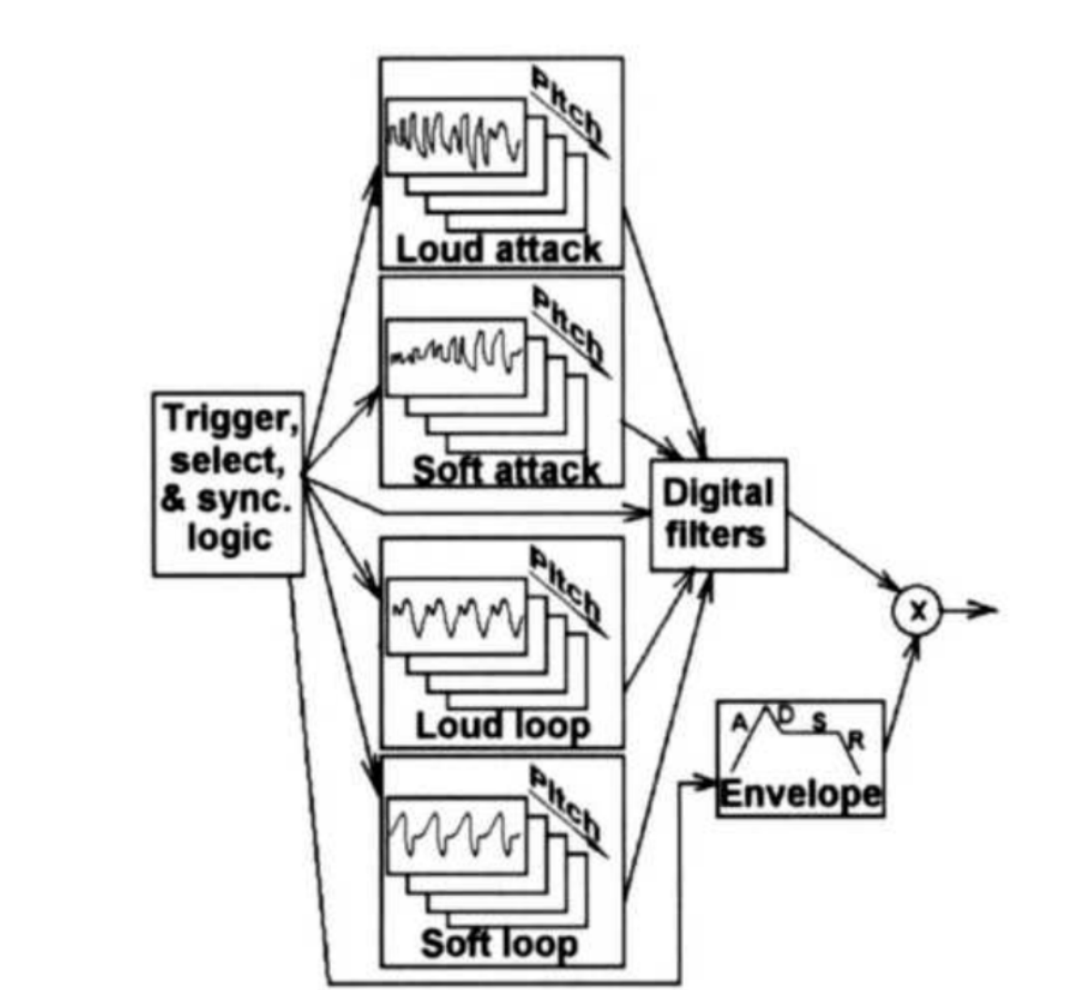
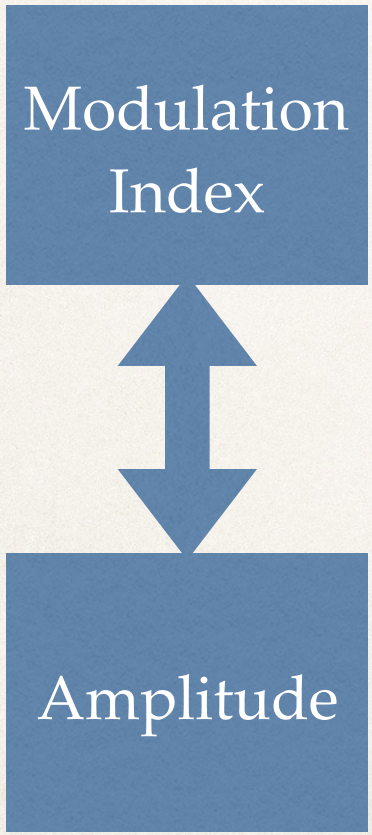


Figure 2.2. Sampling synthesis block diagram.

Imitation der Natürlichkeit

- A: CMJ Seite 229



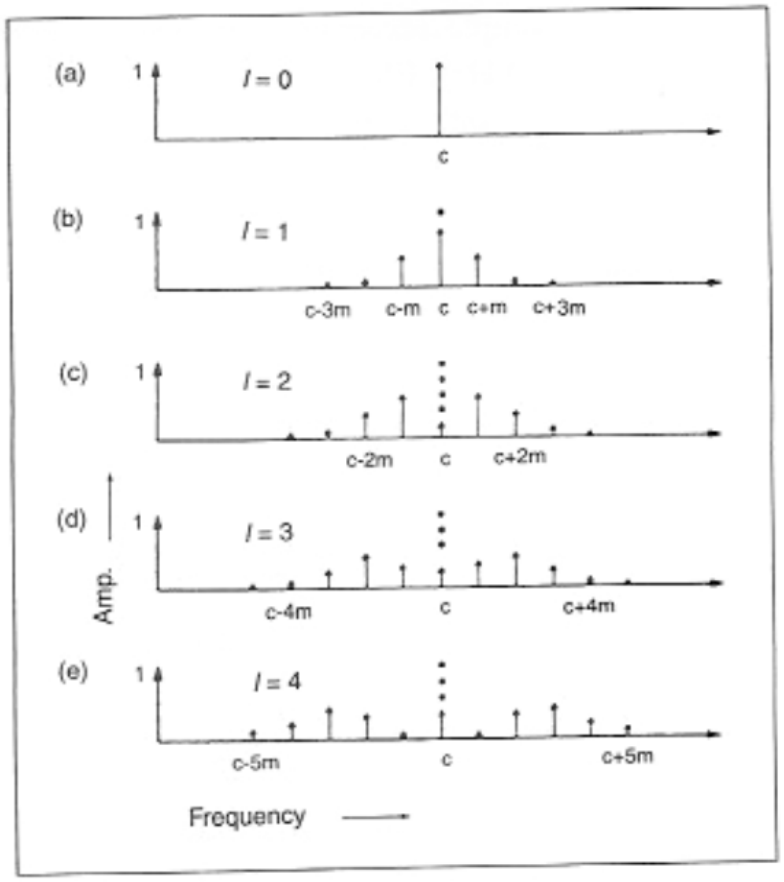


Figure 6.11 FM spectrum with increasing modulation index. (*a*) Carrier. (*b*)–(*e*) Carrier plus sidebands for $I = 0$ (see *a*) to 4 (see *e*). The sidebands are spaced at intervals of the modulating frequency M and are symmetrical about the carrier C. (After Chowning 1973.)

Imitation der Natürlichkeit

- Waveshaping Synthese

Waveshaping

- F: Wer ist der Erfinder von Waveshaping Synthese?

Waveshaping

- A: Jean-Claude Risset

(* 18. März 1938 in Le Puy-en-Velay)

Komponist

- Sud
- Mutations
- Songes

Erfinder von Shepard-Risset Glissando

https://en.wikipedia.org/wiki/Shepard_tone

https://www.youtube.com/embed/Fhj2O4jToKI

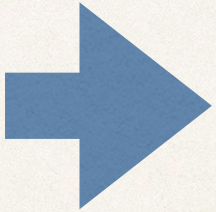
Waveshaping

- F: Was ist der Vorteil von Waveshaping?

Waveshaping

- A:

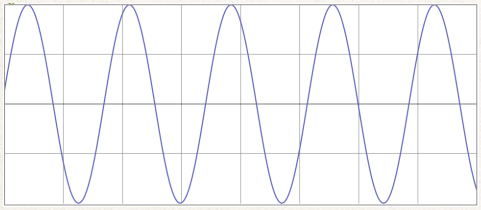
Waveshaping is musically interesting because, as in FM synthesis, it gives us ***a simple handle on the time-varying bandwidth*** *and spectrum of a tone in a* ***computationally efficient way****.*



Einfach und effizient

Waveshaping

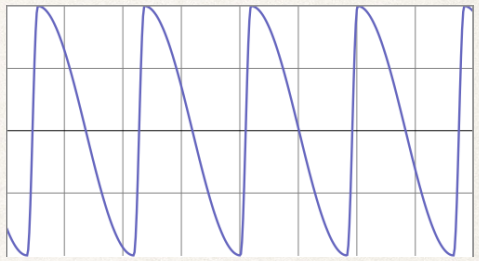
x



Sinus

distortion Box

w(x)



Waveshaping

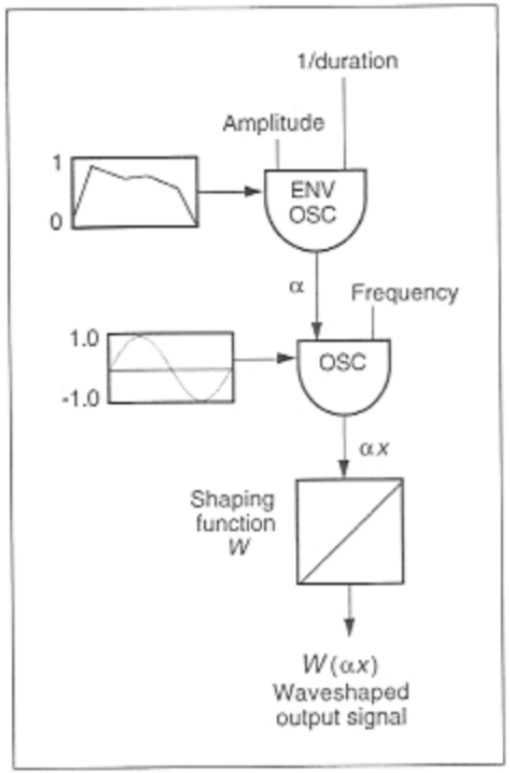


Figure 6.26 Simple waveshaping instrument. A sinusoidal oscillator, whose amplitude is controlled by the amplitude envelope signal α, indexes a value in the shaping function table *w*. As in other example instruments, the input *1/duration* that is fed into the frequency input of the envelope oscillator indicates that it goes through one cycle over the duration of the note.

Simple Waveshaping Instrument

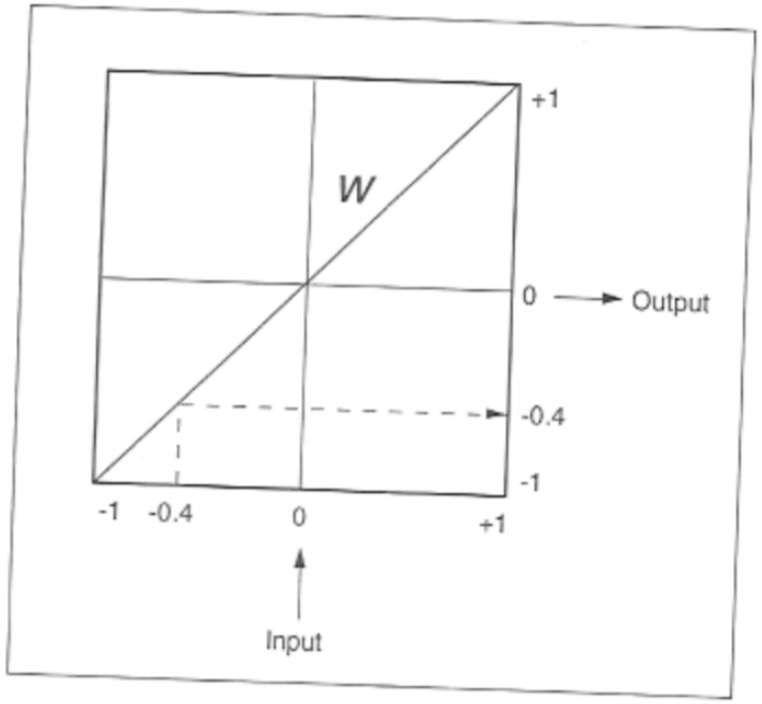
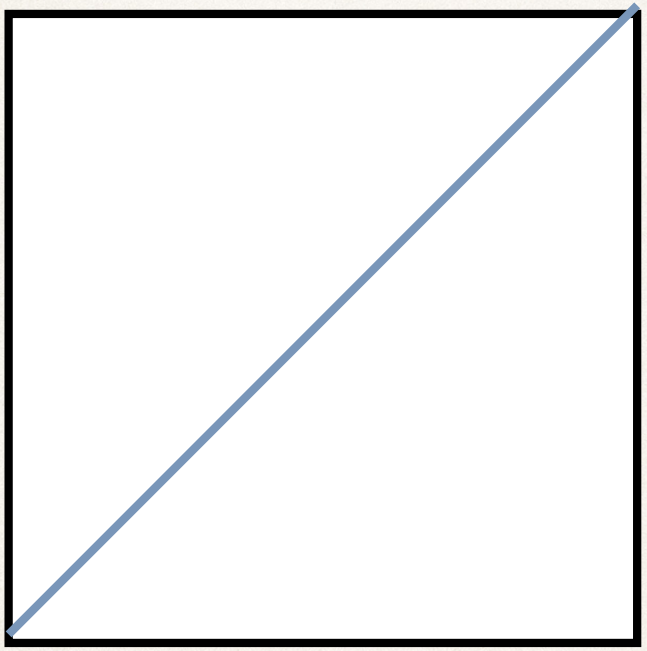
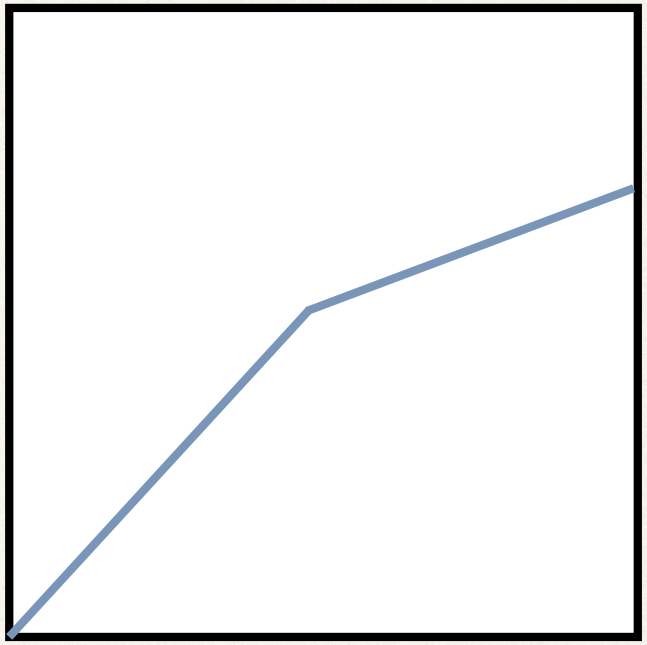


Figure 6.27 Shaping function shown with a linear response. The function maps an input signal scaled over the range shown at the bottom to an output function whose scale is shown at the right. To see how the function maps an input to an output value, read vertically from the bottom and then look to the right to see the corresponding output value. Thus an input value of −0.4 on the bottom maps to an output value of −0.4 on the right. This equivalence between the input and the output is only true for a linear shaping function.

Übertragungsfunktion

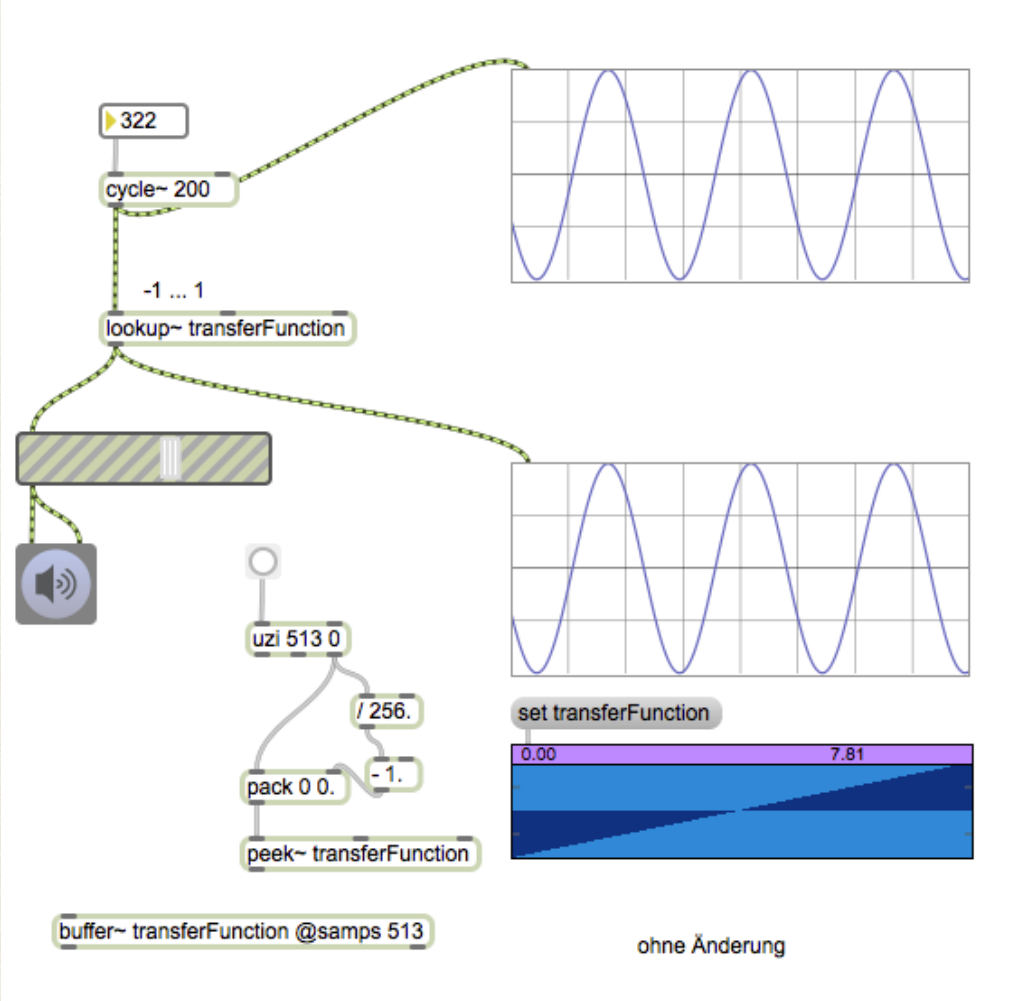


( ) funktion



( ) funktion

Beispiel im Max



waveshaping.maxpat

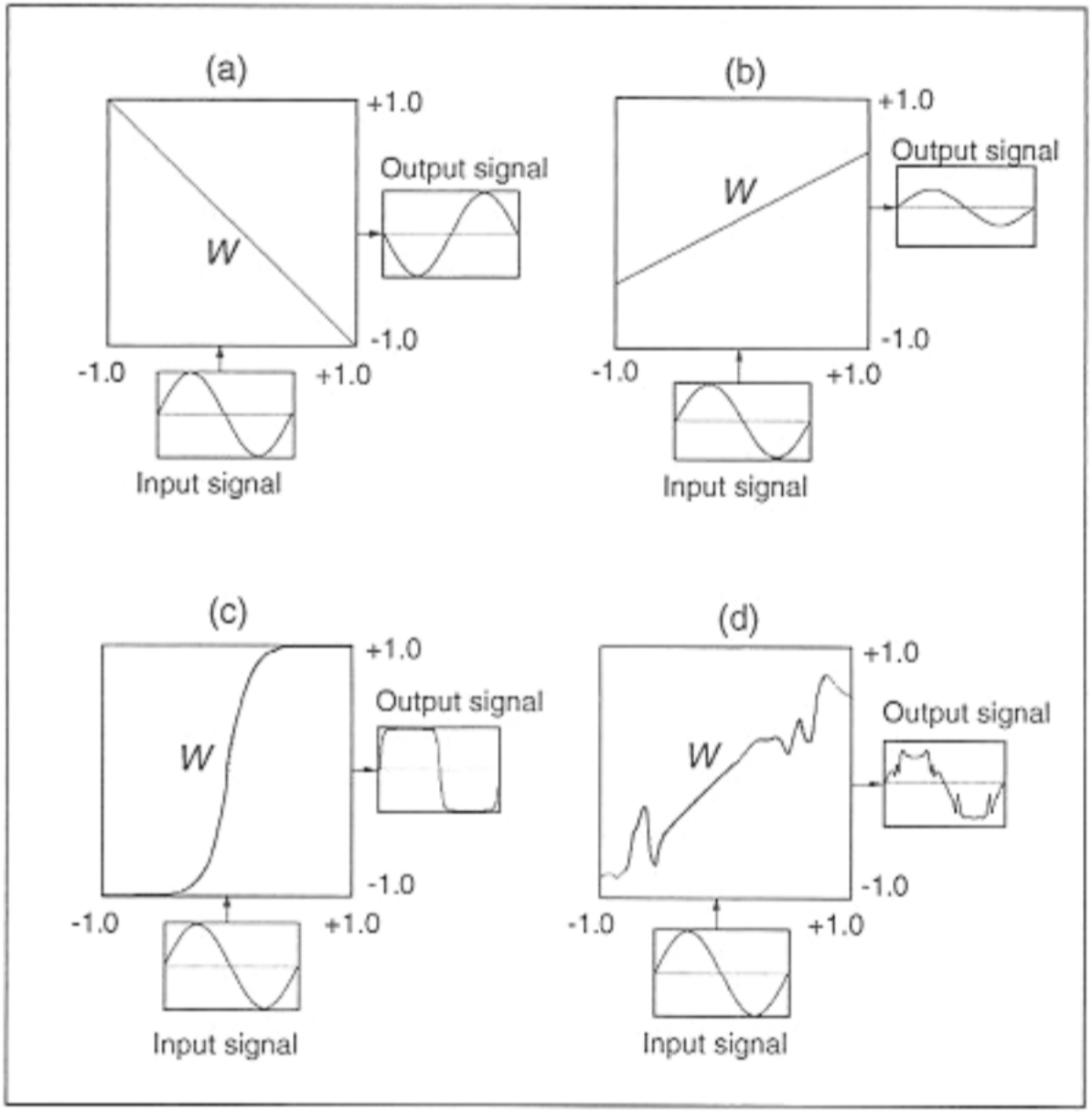
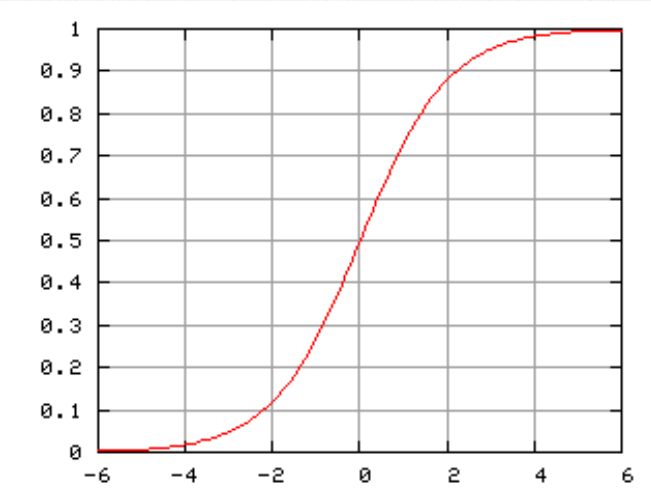


Figure 6.28 Four shaping functions. (*a*) Inversion of the input signal. (*b*) Attenuation. (*c*) Amplification of low-level signals (expansion) and clipping of high-level signals. (*d*) Complicated amplitude-sensitive distortion.

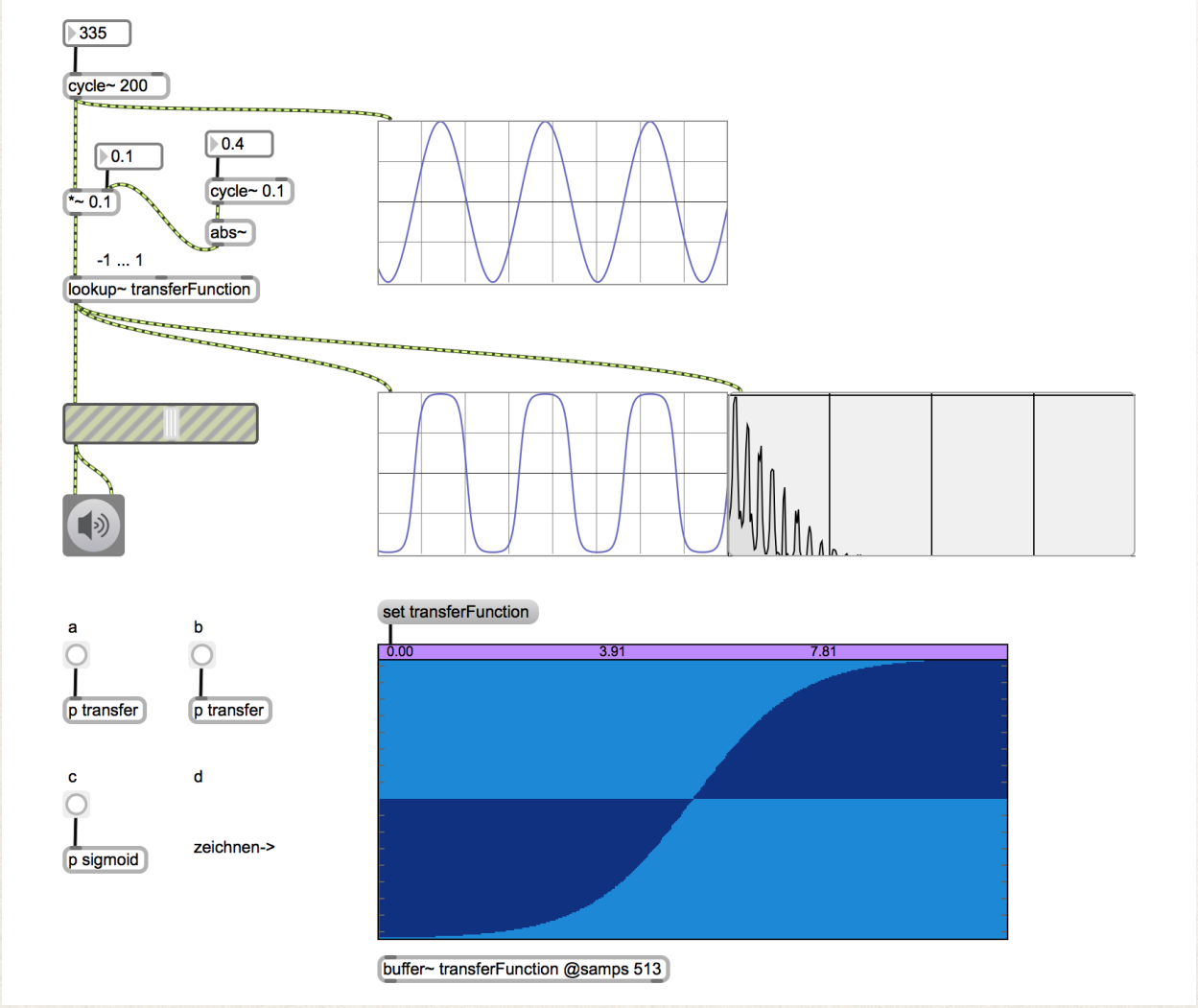
non linear function

Sigmoid Funktion

$$\varsigma_1(x) = \frac{1}{1 + e^{-x}} = \frac{\tanh(x/2) + 1}{2}$$



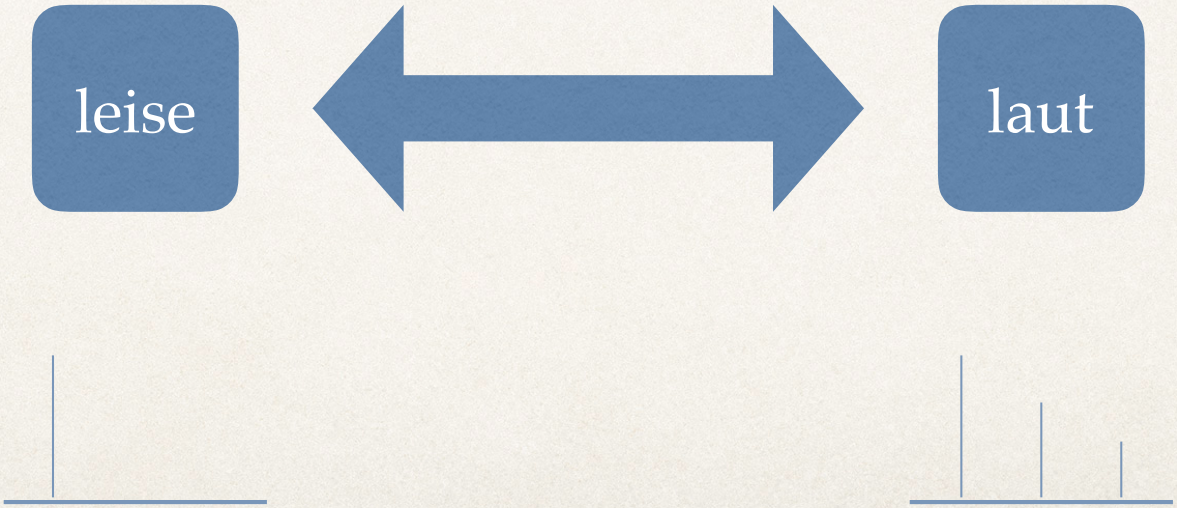
Beispiel im Max



waveshaping_tf.maxpat

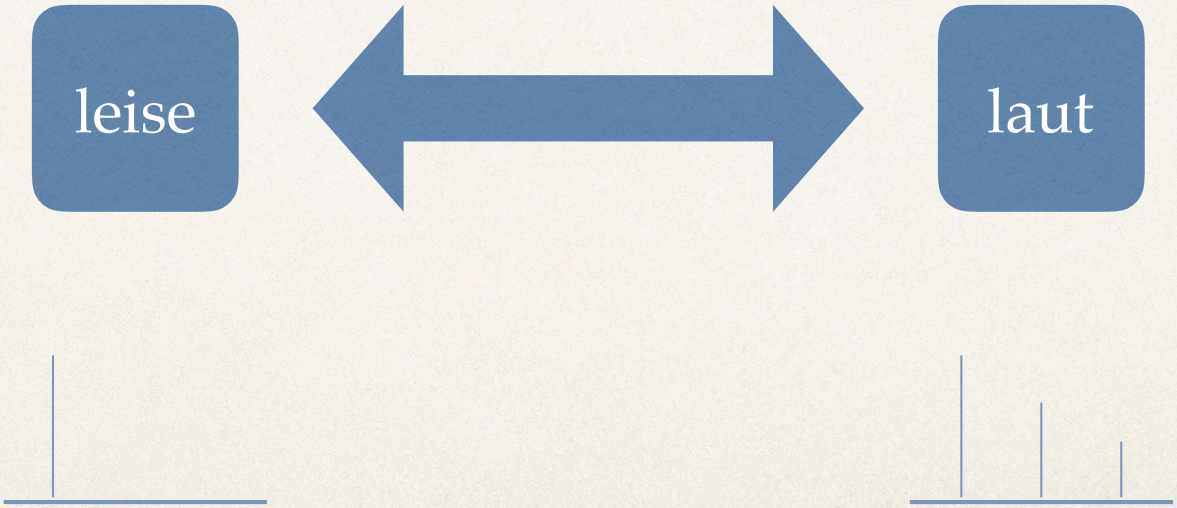
Eigenschaft

- It is easy to see that the ( ) of waveshaping can model a characteristic of acoustic instrument.



Eigenschaft

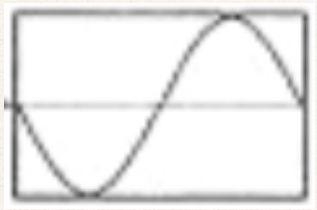
- It is easy to see that the **Amplitude Sensitivity** of waveshaping can model a characteristic of acoustic instrument.



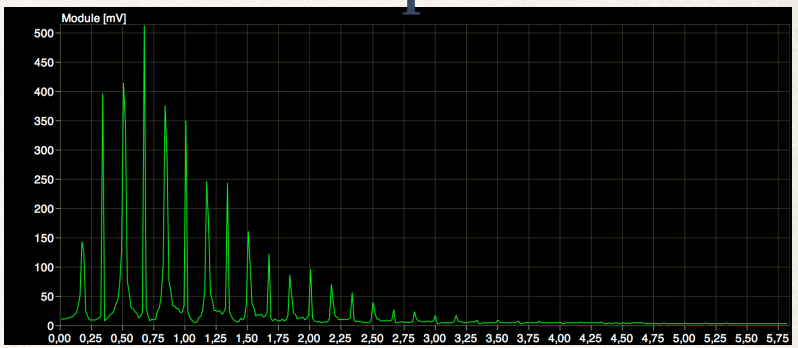
Eigenschaft

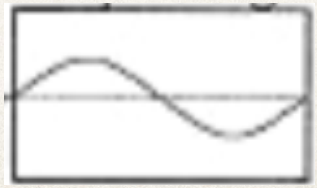
- a variation in the time domain at the input is manifest as a variation in the frequency domain at the output.

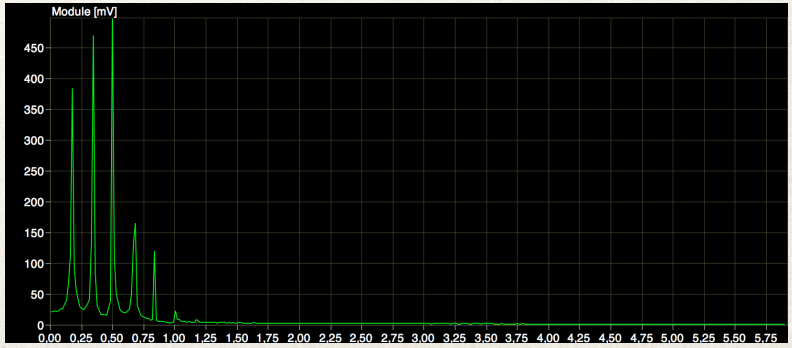
input



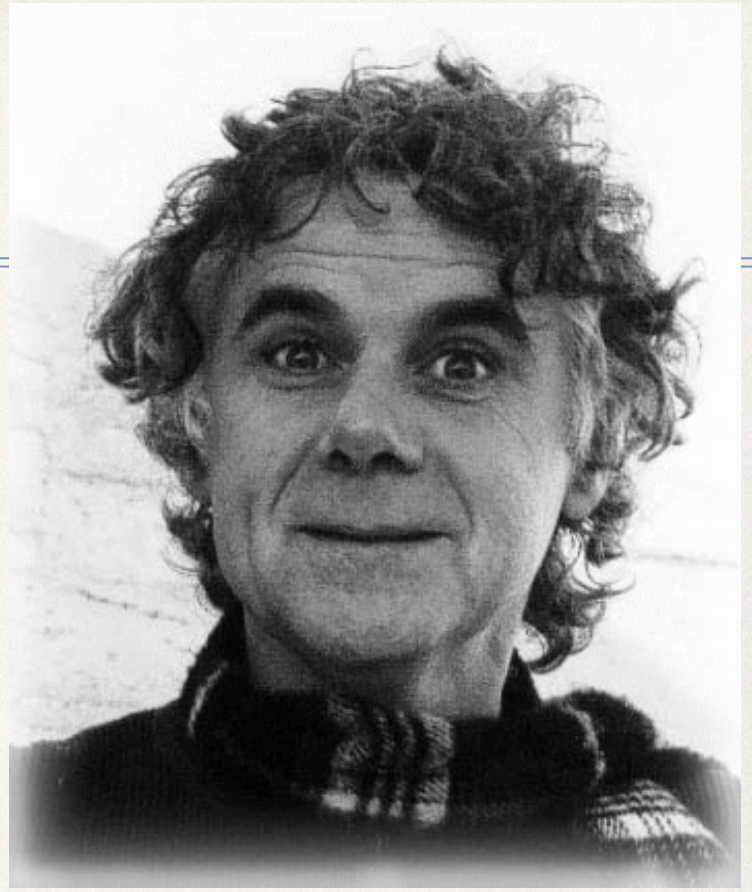
output







Klangbeispiele



- Daniel Arfib

  Forscher und Komponist
  von Waveshapingsynthese

https://www.youtube.com/watch?v=qpirBLRGfFk