Resonator section

Controls

A. COARSE and FINE frequency controls. They control the fundamental frequency of the resonator’s frequency response. COARSE is quantized by semitone increments.

B. Attenuverter for the FM CV input.

C. Instrument GEOMETRY. This parameter adjusts the frequencies, gains, and Q-factors of the resonator’s filters in order to simulate various structures and materials. As you rotate this knob, you’ll find:
   - Plates [metal]
   - Strings [steel, nylon]
   - Bars and tubes [glass, wood]
   - Bowls [glass, metal]

D. BRIGHTNESS. Controls the damping of high frequencies. Low values of this parameter simulate materials like wood or nylon. High values simulate materials like glass or steel.

E. DAMPING controls how quickly energy dissipates through the material. Modulating this parameter by CV can recreate the effect of damping or muting the sound by blocking the vibrating surface with the hand.

F. POSITION controls on which point of the structure the excitation is applied. Applying the excitation right in the middle of the surface will cause even harmonics to cancel each other, resulting in a hollow sound reminiscent of a square wave. POSITION is nature’s PWM/phaser effect!

G. SPACE. Stereo control and reverberation. When this knob is set to its minimum position, the left channel contains the exciter output, and the right channel the resonator signal - for further external mixing. As SPACE increases, a stereo effect is created by picking up the vibrating surface’s sound at two different positions. Past 12 o’clock, SPACE controls the amount and decay time of an algorithmic reverb applied to the resonator signal.

H. Attenuverters for the CV inputs.

Inputs and outputs

1. CV inputs for the five resonator parameters.

Tips and Tricks

The resonator can behave like a formant filter. Feed a sawtooth or narrow PWM signal to one of the external inputs, set BRIGHTNESS to a low value, DAMPING to a low value, and modulate GEOMETRY to go through various configurations of formants. Then sweep the main frequency.

A very high CV on the SPACE CV input causes the reverb to have an infinite decay (freeze effect).

Please refer to the online manual for detailed information regarding compliance with EMC directives.
Installation
Elements requires a -12V / +12V power supply (2x5 pin connector). The red stripe of the ribbon cable (-12V side) must be oriented on the same side as the “Red stripe” marking on the board. The module draws 10mA from the -12V rail and 130mA from the +12V rail.

Online manual and help
The full manual can be found online at mutable-instruments.net/modules/elements/manual
For help and discussions, head to mutable-instruments.net/forum

Understanding modal synthesis
To imitate nature and acoustic instruments, modal synthesis breaks down the creation of sounds into two steps:

1. Synthesizing a noisy and/or percussive excitation signal, which represents the raw energy transferred to the instrument by the musician when (s)he bows, blows or strikes it.

2. Processing this excitation by a resonator modeling the vibrating structure itself and its environment - be it a string, tube or plate. Properties such as its size, tuning, shape and material can be simulated by adjusting the parameters of the resonator.

Control and exciters section
Overview
Three generators are available to build an excitation signal:
BOW produces a continuous, granular scratching noise, which is smoothed by a built-in low-pass filter; and a purer tone interacting with the resonator frequency.
BLOW produces a continuous granular noise, whose pitch and color can be altered.
STRIKE plays samples of percussive attacks, or synthesizes bursts of impulsions. These sounds are sculpted by a low-pass filter.
The BOW and BLOW signals are enveloped by a built-in ADSR contour generator.

Controls
A. ADSR CONTOUR. Morphs through preset shapes.
B. Excitation mixer. Adjusts the level of the BOW, BLOW and STRIKE generators.
C. Press and hold this button to trigger the exciter. This is equivalent to sending a positive gate to the GATE input.
D. Air FLOW. Scans through various flavors of noise. Controlling this parameter with a CV (for example, from a slow LFO), will create an evolving texture reminiscent of a turbulent air flow.

Inputs and outputs
1. 2. Main V/OCT CV input, and FM CV input. They control and modulate the note to which the resonator is tuned.
3. GATE input. Triggers the STRIKE generator and starts the course of the BOW/BLOW envelope.
4. STRENGTH CV input. This CV boosts or attenuates the amplitude of the three exciters, with a gain of +3dB/V. Ideal for velocity control or accentuation by a sequencer.
5. 6. Resonator external audio inputs. Before being sent to the resonator, the signal from the first input goes through the BOW/BLOW envelope and diffuser; while the second input signal does not undergo any further processing.
7. 8. Stereo audio output. Depending on the position of the SPACE knob, this consists of either the individual exciter/resonator components, or a true stereo pair with reverb.
9. CV inputs for the five exciter parameters.