

Krell

from an original design by James Hutchby

Krell has the following features:

- 4 DCOs (digitally-controlled oscillators) + mixer
- pitch and amplitude LFOs
- waveforms - sine, square, triangle, rising sawtooth, falling sawtooth, pulse, noise
- frequency modulation and ring modulation
- delay line with feedback
- flanger
- user patch (non-volatile)
- MIDI and command line interfaces

The fundamental sound generators in *Krell* are digitally-controlled oscillators (DCOs). Four are available and their pitch (frequency), amplitude (volume) and waveform can be individually controlled. The frequency range of the oscillators is from ~30Hz to ~8kHz (8 octaves). The four oscillators are mixed together to produce the audio output.

The available waveforms are the standard set available in many analogue synthesisers - namely sine, square, triangle, rising sawtooth, falling sawtooth, pulse, and white noise. The pulse width of the pulse waveform is continuously variable.

The pitch and amplitude of each DCO can be modulated (varied) by a pair of low-frequency oscillators (LFOs). Pitch modulation is known as vibrato and amplitude modulation is known as tremolo. The same set of DCO waveforms is available for the LFOs and the frequency and amplitude of each LFO can be independently varied.

The pushbuttons (S1 to S6) are used to select one of 12 modes. Pressing and releasing S1 selects mode #0, pressing and holding S1 selects mode #1, pressing and releasing S2 selects mode #2, pressing and holding S2 selects mode #3, and so on. Refer to the table below to see the effect of the presets in each mode. The pattern of running lights changes with the mode.

The presets remember their previous positions when the mode is changed and subsequent movements are relative to the previous position. To obtain the full range of values from a preset it may be necessary to move it first to the two extremities of its travel.

A ring modulator is available which produces bell-like sounds rich in inharmonic partials. Pairs of oscillators can be ring modulated (their waveforms are multiplied together).

Pairs of oscillators can also be frequency modulated (the first oscillator in each pair modulates the second). This is similar in function to the pitch LFOs but the frequency of modulation is not limited to a low rate.

A flanger is available which acts as a dynamic filter removing a set of regularly-spaced frequencies from the sound spectrum (i.e. a comb filter). The position of the filter notches is under the control of a separate LFO, and the range, waveform and speed of frequency sweep are all controllable. (The flanger is implemented as a variable-length delay line and its parameters affect the instantaneous length of the delay line.)

A longer delay line is also available for reverb effects. Feedback can be applied to the delay line to produce complex non-linear effects. Reverb, particularly with feedback, is very effective at generating sci-fi type sound effects.

Additive synthesis means that the frequencies of DCOs #1, #2 and #3 are locked to respectively 2, 3 and 4 times the frequency of DCO #0 (the fundamental).

Fuzz can be used to distort the output of the mixer by clipping the waveform to a limit.

The current settings can be stored in non-volatile memory and restored later.

A number of demo sounds are pre-programmed.

A master volume control is provided. *Krell* can output an audio signal on its jack socket which has a maximum peak-to-peak of about 2 volts. This is more than capable of producing a loud sound in a pair of 32-ohm impedance headphones.

Command line interface

serial communications 9600N1, no handshaking, no echo

responds to command line terminated by carriage return

arguments in ASCII decimal

H[elp] – displays command summary

V[olume] <vol> – sets master volume, <vol> = 0 (silent) to 16 (maximum) (default = 7)

P[rogram] <prog> – sets program, <prog> = 0 (user) or 1 to 14 (demo)

C[ontrol] <cntrl> <val> – sets control, <cntrl> = 0 to 71, <val> = 0 to 4095

D[isplay] – displays all controls

MIDI interface

responds to control change messages on all MIDI channels

controller number = 0 to 71, controller value = 0 to 127

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Pushbutton(s)	
S1	select mode 0/1
S2	select mode 2/3
S3	select mode 4/5
S4	select mode 6/7
S5	select mode 8/9
S6	select mode 10/11
S1 + S6	restart
S1 + S2	save settings to memory
S5 + S6	restore settings from memory
S1 + S3	cycle demo bank #1
S4 + S6	cycle demo bank #2
S2 + S5	cycle demo bank #3

Mode	#0	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11
VR1	DCO #0 waveform	DCO #0 amplitude LFO pulse width	DCO #1 waveform	DCO #1 amplitude LFO pulse width	DCO #2 waveform	DCO #2 amplitude LFO pulse width	DCO #3 waveform	DCO #3 amplitude LFO pulse width	off/ring modulation/ frequency modulation on DCOs #0 and #1	reverb period LFO pulse width	master volume	
VR2	DCO #0 pitch LFO waveform	DCO #0 amplitude LFO waveform	DCO #1 pitch LFO waveform	DCO #1 amplitude LFO waveform	DCO #2 pitch LFO waveform	DCO #2 amplitude LFO waveform	DCO #3 pitch LFO waveform	DCO #3 amplitude LFO waveform	reverb feedback	reverb period LFO waveform	fuzz (hard clipping)	
VR3	DCO #0 pitch LFO frequency	DCO #0 amplitude LFO frequency	DCO #1 pitch LFO frequency	DCO #1 amplitude LFO frequency	DCO #2 pitch LFO frequency	DCO #2 amplitude LFO frequency	DCO #3 pitch LFO frequency	DCO #3 amplitude LFO frequency	off/ring modulation/ frequency modulation on DCOs #2 and #3	reverb period LFO frequency	additive synthesis	
VR4	DCO #0 pitch LFO amplitude	DCO #0 amplitude LFO amplitude	DCO #1 pitch LFO amplitude	DCO #1 amplitude LFO amplitude	DCO #2 pitch LFO amplitude	DCO #2 amplitude LFO amplitude	DCO #3 pitch LFO amplitude	DCO #3 amplitude LFO amplitude		reverb period LFO amplitude		flanger pulse width
VR5	DCO #0 pitch	DCO #0 pulse width	DCO #2 pitch	DCO #1 pulse width	DCO #2 pitch	DCO #2 pulse width	DCO #3 pitch	DCO #3 pulse width	reverb period		flanger frequency	flanger waveform
VR6	DCO #0 amplitude	DCO #0 pitch LFO pulse width	DCO #1 amplitude	DCO #1 pitch LFO pulse width	DCO #2 amplitude	DCO #2 pitch LFO pulse width	DCO #3 amplitude	DCO #3 pitch LFO pulse width	reverb level		flanger amplitude	flanger base