Using the LFOs in FXCore

FXCore contains four digital sine wave LFOs providing both SIN and COS outputs along with two digital ramp LFOs. These LFOs are available to the programmer to use in their code and may also be used by the FXCore in certain instructions, i.e. the ramp is used in pitch shifting (please see AN-2 “Using the PITCH Instruction”) while the sine waves are used in chorus generation (please see AN-X “Using the CHR Instruction”).

The sine wave LFOs are designed for low frequency (0 to 100Hz at 32K sample rate) operation and may become distorted or unstable at higher frequencies due to the algorithm used to generate the waveforms.

The frequency of operation for the LFOs is dependent on sample rate as they are updated once per sample period. For the SINE based LFOs the equation to calculate the coefficient for a given frequency is:

$C = (2^{31} - 1) * (2*pi*F)/F_S$

F = Target frequency in hertz
F_S = Sample rate

Short example of creating an LFO with a 0 – 100 Hz with sin out on channel 0 and cos on channel 1

```
// Example using sine LFO - an-3_a.fxc
// This example creates a 0 - 100 Hz LFO with the sin on channel 0
// and the cos on channel 1, POT0 controls frequency

// Read POT0 smoothed value
cpy_cs r0, pot0_smth

// Load 0x02750000 into r1 which give a top LFO speed of about 100Hz at 32K
wrdld r1, 0x0275

// Multiply POT0 by the coefficient, result in ACC32
multrr r0, r1

// Write it to the LFO0 frequency control register
cpy_sc lfo0_F, acc32

// Get the sin wave
cpy_cs acc32, lfo0_s

// Write it to channel 0 output
cpy_sc out0, acc32

// Get the cos wave
cpy_cs acc32, lfo0_c

// Write it to channel 1 output
```

```
cpy_sc out1, acc32
```

For the ramp LFOs the equation is a little simpler as it is just an increment added to the ramp value each sample period and the ramp is allowed to roll over from +1.0 to -1.0

$C = (f/F_S) * 2^{32}$

f = Target frequency in hertz
F_S = Sample rate

Short example generating a ramp wave that ranges from 0 to 1KHz at 32K sample rate where POT0 controls the frequency and outputs the ramp on channel 0:

```
// Example using sine LFO - an-3_b.fxc
// This example creates a 0 - 1 KHz ramp on channel 0
// POT0 controls frequency

// Read POT0 smoothed value
cpy_cs r0, pot0_smth

// Load 0x07D00000 into r1 which give a top speed of about 1KHz at 32K
wrdld r1, 0x07D0

// Multiply POT0 by the coefficient, result in ACC32
multrr r0, r1

// Write it to the ramp 0 frequency control register
cpy_sc ramp0_F, acc32

// Get the ramp wave
cpy_cs acc32, ramp0_r

// Write it to channel 0 output
cpy_sc out0, acc32
```

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Experimental Noize Inc.

Scottsdale, AZ USA

www.xnoize.com

sales@xnoize.com