

Synth Programming (pt III)



How to make scarier, wilder noises in part III...

OVER THE LAST couple of editions of this series of analogue synth programming we've been dealing with the basics of analogues. But the trouble with the basic analogue patch we've been talking about over the last few months is that it's only capable of a limited number of sounds.

True, you can get basses, pads and leads out of it. But they all have a very samey quality. Part of the problem is that using simple oscillator waveforms is boring. Even detuned and filtered, two sawtooth waves playing together still sound like two sawtooth waves. And if you listen to just about any professional dance CDs, you'll soon notice some of the sounds are more complicated than that.

So what can you do? First off, there's noise. Just about all synths have a noise option, which is not, as you might expect, any old generic sound, but means something quite specific. In a synth context, noise is a whooshing sound, much like what you'll get out of a TV when it isn't tuned to any channel.

Technically it's like having an infinite number of oscillators tuned to an infinite number of pitches all varying in volume randomly, so essentially there's no definite pitch at all.

Noise is sometimes referred to by colours. Most synths will have a white noise option which is more trebly and hissy while pink noise is more of a deep bass rumble. It's really easy to make ambient wind and surf effects by running either of these noise through a filter... if you're that way inclined of course.

Perhaps surprisingly noise is also useful for synth drum sounds. A short dose of white noise sounds a little bit like a snare sound, although you'll usually need to fill it out with an oscillator or two, and perhaps some other processing, in order to create a sound which is interesting enough to be useful.

Then there's the sample playback option. Instead of a simple waveform, you get a sample (or a recording) of a real instrument: piano, guitar, orchestral strings, another synth or whatever. Although it was invented in the mid 80s, this kind of synthesis is still popular. Synths like the Korg Trinity and Triton and the Roland JV series use it to good effect because it's a cheap shortcut way to get real(ish) instrument sounds out of a keyboard. PC soundcards do this too.

You can still shape the sound with filters and the amplifier, so if you want a piano sound with a slow fade in, this is the way to do it. Or you use the same approach to go the pretend analogue route. Keyboards like the Quasimidi Sirius come with a whole load of synth samples already in place. This practice, known as sample + synthesis, is a cheap and easy way of getting analogue noises out of simple digital hardware.

The big problem is the sounds tend to be canned. If you want a really fat analogue sound, you're unlikely to get it this way because samples simply can't duplicate the life and variation of a real analogue synth.

One of the reasons for this is because better analogue synths offer another couple of more complicated options which we haven't looked at yet. If you want interesting and unique analogue sounds, as opposed to just plain predictable ones, it helps a lot to understand how these work.

What's the frequency Kenneth?

Frequency modulation or FM (not to be confused with the abbreviation for a certain well-known, bestselling, monthly music technology magazine of course) enables you to wobble the pitch of one oscillator with another. You can get fat ripping, tearing, and bell-like sounds this way.

Some synths (such as the Pro-Five soft synth reviewed in FM issue 96) also let you control the filter like this for similar effects. The exact sound you get depends on the pitch relationship between the oscillators, and on how much you apply.

On high-end analogue synths you'll often see a knob marked FM or perhaps FM depth which controls exactly this.

On very high-end synths you can create dynamic depth FM by routing the oscillator which is doing the wobbling through an amplifier controlled by an envelope generator.

Basic analogue FM is easy enough to handle. As soon as you start experimenting you'll hear that at most oscillator ratios and depths the sound is pretty much a wibbly, out-of-tune mess; possibly useful if you're Trent Reznor but otherwise not.

Once in a while though, at certain magic settings - which you have to find by trial and error - the sound snaps into focus and you get interesting, rich tones which sound nothing like conventional analogue synthesis. You can make hollow-sounding pads, bell sounds, chunky slappy basses or ear-bending leads like this.

There's a lot of maths behind FM which usually gets quoted in articles like this, but you needn't worry about that. (Not unless you're a bit of a sad anorak who loses sleep over these things). All you really need to know is using trial, error and your ears will get you a lot further than any amount of wibble about modulation indices and Bessel functions.

That syncing feeling

Another option you can use is called oscillator sync. This makes classic screaming solo sounds. It ties one oscillator to the pitch of another, so you get a waveform which is a combination of the two. As the relative pitch changes, the slave oscillator is forced to follow or sync to the pitch of the master. In practice this means the true pitch doesn't change but the sound quality changes dramatically. Typically it starts to scream or wail in a distinctive kind of way.

Like FM, sync is a high-end kind of feature which you only find on more expensive synths. Usually all you get is a button or menu option which turns it on and off for the slave oscillator(s). You can get some fun effects by using an LFO or envelope to change the pitch of the oscillator which has been sync'd up.

There's nothing to stop you using sync on pads and bass sounds but it's usually a bit full-on for anything which isn't right at the front of a mix. There's also nothing to prevent you from using FM and sync together. When you do, strange things happen. In fact what you get depends very much on what synth you're using.

This is where sound programming can be fun; it's not just about theories any more, it's about pushing the limits of what your kit can do and creating some excellent and unique sounds in the process.

Waving away

Some synths - particularly the Waldorf Wave and Microwave and the Access Virus - get more from their oscillators by offering wavetable synthesis. With this, you get a library of simple waveforms which the oscillator can play.

But instead of setting up the oscillator with, say, a modified sawtooth from the library and sticking with it, you can switch between waveforms with an envelope or LFO while the oscillator is playing. In effect the oscillator morphs between one waveform and another. Or it can switch randomly between completely unrelated waveforms.

Wavetable synthesis is great for spiky and sharp digital sounds or for slowly evolving random pad sounds. Waldorf's Wave series even lets you upload your own wavetables. So you can start with a sample which has been converted into a wavetable and scan through it to create your own completely original sounds.

Korg made a synth (actually a range of synths) called the Wavestation, which used nothing but wavetable technology. These are still popular with anyone who wants pad sounds which go on forever without repeating.

Wavestations can also create rhythmic sample sequences. The Wavestation presets soon became clichés, but anyone who has a Wavestation and hasn't experimented with it will find they can create some unique riffs and lines by stringing together some of the sounds in the preset sample memory.

Give me a ring

One final option found on some synths is a ring modulator. If you put two pure pitches through a ring modulator you get two different pitches out the other end. Because of some devilishly complicated and fiendishly clever design, the end pitches happen to be the sum and difference frequencies.

So, if you put 300Hz and 400Hz sine waves in (if you remember from last month's Synth programming feature, sine waves are pure tones with no other ingredients) you get sine waves at 100Hz (400Hz - 300Hz) and 700Hz (400Hz + 300Hz) out the other end.

If you feed in more complex tones, with more complex ingredients, each of the ingredients will produce sum and difference tones of their own. The end result usually sounds like a clanging, bell-like sound, or like some of the

weird noises radios make.

If you change any of the pitches you can actually hear the sum and difference tones moving in opposite directions.

So what use is this in practice? Well, ring modulators are great for fattening up sounds, for giving analogue sounds a bit of a digital edge, and of course, for bell-like or shortwave radio noises and effects.

As usual you can forget the theory for most things and just use your ears. As a rule though, if you have a sound which is too rounded and analogue, plugging in a ring modulator, or turning up its volume, can be an excellent way to give it more character. Another use for a ring modulator is simulating cymbals, hi-hats and other synth percussion.

Skip to my filters?

So what about filters? Filters have their own options and complications. Most synths have low-pass filters which let bassy sounds through, but trim off the treble. These are the most useful kind, but if you build a track out of lots of low-pass filtered sounds things can get muddy and unclear down at the bottom end.

High-pass filters remove the bass. These are great for stringy pad sounds, for simulating hi-hats and other synth percussion. Band-pass filters remove both bass and treble and keep the bit in the middle. As with high-pass filters, these are worth using to avoid low-end audio sludge in a track. They're also excellent for mid-range sequenced sounds that cut through a mix. (The filter on the TB-303 is a kind of cross between a low-pass and a band-pass, which is one reason why the 303 sounds so up-front when you turn up the resonance on it.)

Some expensive synths have two filters instead of one. On some you can connect these in series or parallel and even control them with separate envelopes and LFOs. Total madness can easily ensue with these and there are no rules about how to use them. Although if you want vocal-ish sounds it's worth knowing about formants, but you'll have to wait until next month to find out about those.

One interesting effect is to put high- and low-pass filters in series, so the sound seems to evaporate from the middle as the filters cross. You also get some interesting and unpredictable interactions between filter types if you blend their outputs. Again, it's best just to experiment.

So that's it for now. In part IV I'll be back with information about how to put everything together and control it over MIDI. See you then!

Richard Wentk Future Music 07/00