It's hard to believe that it has been over 20 years since Yamaha started the FM synthesis craze by releasing the DX7 synthesizer. I mean, it seems like only yesterday I was dancing up a storm to Depeche Mode, Images in Vogue, and New Order. <awkward pause> Ok, actually that *was* last night ..at a rather popular retro-80's night here in Ottawa; all of which serves to underscore my point. Many of the synth sounds of the mid 80's are back in style, though perhaps with tongue planted semi-firmly in cheek. From approximately 1984-1988 there was scarcely a top ten hit that *didn't* use the unique FM synth sounds of the DX7, and with a software plugin of that instrument now available, those sounds are creeping back into our musical lexicon again. Has Whitney Houston *ever* made an album that didn't have the DX7 Rhodes Piano patch?

So what is FM synthesis? Frequency Modulation synthesis (FM for short) takes a completely different approach than your standard Analog Subtractive synth. For starters it looks suspiciously more like a form of additive synthesis, whereby sounds are created by adding simpler tones into a more complex result. It also happens to generally be a digital form of synthesis, though it needn't (as some seem to think) necessarily be the case. Digitally precise tuning allows it to be far more accurate in both its tonal recreation and tuning stability than analog attempts at this type of sound creation. Machines like the (analog) Oberheim Matrix 12 had FM capabilities, but for this application, oscillator tuning drift has a tendency to really expose itself rather awkwardly. Why? Because on a standard subtractive synth, if oscillators go out of tune we only hear fluctuations in pitch, and our ears have a certain tolerance for this. Indeed, as I've said before, it is that fluctuation in pitch that helps contribute in a positive way to the overall 'warmth' of the analog sound. In FM, tuning drift also affects the *tone* of the individual sound - something our ears are far more sensitive to. I'll talk about this more in a minute.

FM as a principle can be demonstrated rather easily on most synths. Apply an LFO to the pitch of any oscillator to create a vibrato effect. Increase the speed of the LFO to the high range and (if it will go this high) into the audio range. Eventually, you will begin to hear new harmonics forming as the two waveforms begin to intersect. These complex series of harmonics are referred to as sidebands and they are predictable, reproducible, and mathematically related. Much of the beauty that results from this form of synthesis comes about because the individual harmonics in the spectra created we perceive as being organically related to each other, albeit in a way we may not be used to hearing. This is the basic principle. In a synth dedicated to FM, oscillators (or in Yamaha-speak, 'operators') can be either a 'carrier' or a 'modulator'. The former are the ones we hear, the latter are the ones that *affect* what we hear. Like LFOs, we don't hear *them* we hear their *effect* on other things. Operators are commonly arranged in combinations of (usually) 6, called algorithms. These allow us to modulate modulators as well as carriers, forming complex strings giving us much control over the sound being created. When the pitch of a modulator changes, it changes the overall tonal character of the sound. This is the strength of FM synthesis - maximum sound generation from minimum input. Awesome. If you've neither an inclination for math nor a very good ear, this kind of synth *may* not be for you. Don't let that discourage you from experimenting though.

FM - like all forms of synthesis - has its strengths and weaknesses. FM is excellent at producing bell-like, metallic, percussive, and very complex tones. More traditional sounds like strings, vocals, or even mimicking analog synths tend to be less convincing, though some might disagree. That being said, synth sounds have a way of taking on a character of their own. More than once I've heard people say "could you get something that sounds like a DX7 sounding like a Minimoog??" ..or something to that effect.

The history of FM synthesis is rather interesting as it displays the academic background of synthesis in general and its influence upon commerce. FM as a sound-*generating* concept was researched and licensed by John Chowning while he was at Stanford University in the late 60's and 70's. He then licensed his findings to Yamaha. I understand the school did pretty well in that little arrangement. The FM concept was well known in the field of radio of course, but it was his research into the mathematical relationships between carriers and modulators and their resulting sounds that garnered him fame. Well, 'fame' so far as it goes. Maybe I need to get out more. I'm going back to retro-80s night.

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