Hi all,

This is an update for those who are interested in composite functions for the windows in Regency Synthesizer. I provide examples of formulas representing multiple windows in a single window while preserving the existing sound, and explain in very general terms where this comes from, *i.e.* without detailed derivations.

The composite function for all three windows in a generator can be written:

alpha(f(beta(g(gamma(h(x)))))) where f(x), g(x), and h(x) are formulas in windows.

f(x) → alpha(f(x))
g(x) → beta(g(x))
h(x) → gamma(h(x))

alpha(f(x)), beta(g(x)), and gamma(h(x))

could be called "normalized formulas" **whose forms depend upon their arguments and are the internal representations inside of Regency Synthesizer**. When the author discussed these formulas in a post in March 2023, he treated them as f(x), g(x), and h(x) without making a distinction from the formulas in the three windows.

Now that the author of Regency Synthesizer has posted that when the leftmost window contains the formula:

sin(2*pi*x)

f(x) → 0.5*sin(2*pi*x) + 0.5, we can see that

alpha(f(x)) = 0.5*f(x) + 0.5 when f(x) = sin(2*pi*x) is in the leftmost window.

Therefore, the composite formula to enter for f(x) = sin(2*pi*x) and g(x) = sin(2*pi*x) in a single window to represent both of these formulas, taking normalization into account is:

sin(pi*sin(2*pi*x)) NOT sin(2*pi*sin(2*pi*x))

the former correctly posted earlier in the OSC 180 thread by kylebenjamin and which comes from

f(beta(g(x)) = sin(2*pi*0.5*(sin(2*pi*x)))

where beta(g(x)) = 0.5*g(x) dropping the 0.5 offset term.

To represent three windows with sin(2*pi*x) in one window: sin(pi*sin(pi*sin(2*pi*x)))

To represent two windows of exp(c*x) next to each other where c is a constant:

exp(c*(exp(c*x) - 1) / (exp(c) - 1)) NOT exp(c*exp(c*x))

To represent a window with exp(c*x) to the left of a window with sin(2*pi*x):

exp(0.5*c*sin(2*pi*x)) NOT exp(c*sin(2*pi*x))

To represent a window with sin(2*pi*x) to the left of a window with exp(c*x):

sin(2*pi*(exp(c*x) - 1) / (exp(c) - 1)) NOT sin(2*pi*exp(c*x))

The domain of x is 0 to 1. The range of the formula in a window needs to be adjusted to 0 to 1, but in the formula, an offset of the range needs to be dropped from the normalization.

I tested these formulas by nulling them with their counterparts. Hopefully no typos! Sometimes there was a very tiny residual sound, possibly due to interpolation differences between separates and combos.

The purpose of this note is to help those who want to combine two or more formulas in existing windows into one window while preserving the existing sound.