Pulse Function

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Hey folks, I need a little help with something. I have a set of three equations that describe Y values for different portions of a graph with 0 <= X <= 30. The first equation, f(X_1), describes the portion 0 <= X <= 10. The second equation, f(X_2), describes the portion 11 <= X <= 20, and the third equation, f(X_3), describes 21 <= X <= 30. I want to combine these three equations into a single formula,

Y= f(X_1) + f(X_2) + f(X_3) (1)

But in this form, I would just have a mess. However, if for each term on the right of (1), I include a factor that reduces the term to 0 for values of X outside of the relevant range and is otherwise equal to 1, then the equation would work. The final equation would look like this:

Y= g(X_1)* f(X_1) + g(X_2)*f(X_2) +g(X_3)* f(X_3)

where

g(X_1) = 1 for 0 <= X <= 10 and is otherwise 0
g(X_2) = 1 for 11 <= X <= 20 and is otherwise 0
g(X_3) = 1 for 21 <= X <= 30 and is otherwise 0

I found a Laplace transform, the pulse function, that seems to do what I want. The pulse function is

F(t) = {exp(−as)*[1−exp(−epsilon*s)]}/s

What confuses me about this is that the left side is a function of t (the x variable) and the right side is a function of s. I have tried to simply replace s with t, but I'm not able to get it to work, probably because my background in math doesn't include Laplace transforms. (I'm not a physicist.)

Returning to the equation,

Y= g(X_1)* f(X_1) + g(X_2)*f(X_2) +g(X_3)* f(X_3)

I'm suspicious that my goal can not be achieved. What makes me suspicious is that if it can be done, this approach could be used to

describe arbitrary curves of any kind. Mathematicians would already be using it all over, but, as far as I know, this approach is not included in curve fitting methods. If it can be done, can someone show me how to configure the pulse function such that it is equal to 1 along an interval and otherwise 0? An example would be especially helpful.

Thanks for any feedback.

Martin

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