Integration: implementation and applications
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Piecewise Functions and Convolution Integrals (Part I, Part II)

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ABSTRACT

In most calculus textbooks, piecewise continuous functions do not constitute an important subject: students are rarely asked to use the fundamental theorem of calculus with a piecewise continuous integrand! But in signal analysis courses, engineering students have to deal with integrals of piecewise continuous functions, especially in the study of a (continuous) linear time invariant system, the so-called LTI system. Here is the reason: if $x(t)$ is the input signal, then the output signal $y(t)$ is the convolution of $x(t)$ with the system impulse response $h(t)$. In other words: $y(t) = \int_{-\infty}^{\infty} x(\tau)\,h(t-\tau)\,d\tau$. Usually, the signals are piecewise continuous and have compact support in order to avoid convergence problems with the improper integral. The talk will show how easy it can be to perform a convolution for any compact support signal using the CAS *DERIVE* and its built-in indicator function (if one signal is an impulse, we can take a limit of indicator function). Then we will try to do the same using the templates of TI-Nspire CAS for piecewise continuous functions. This will require conversions from piecewise to indicator functions. Some results presented at ACA 2013 will be used and extended.

Keywords

Symbolic integration of piecewise functions, convolution.