Savitzky-Golay Filter Function
In case of measured signals or data it is hard, if not impossible, to completely avoid all the possible sources of noise which can muddy any experimental measurement. But the presence of noise can perturb important characteristics of the data (e.g. the FWHM of a measured spectrum). Hence, it might be helpful to have some postprocessing tricks up one’s sleeve. Here we talk about just one such tool: the Savitzky-Golay filter, which smooths out local noise by performing a regression algorithm on groups of sampling points. In this example, we discuss the options and effects of this feature in VirtualLab Fusion along the example of the measured spectrum emitted by a green LED lamp with 60 nm bandwidth.
How to access the Savitzky-Golay Filter

For every real-valued data array the Savitzky-Golay Filter can be found under Manipulations → Miscellaneous → Savitzky-Golay Filter.
The filtering process entails fitting a polynomial of a certain order to groups of sample points. The number of sampling points considered in a group is defined by the Window Size parameter while Order controls the order of the used polynomial. The central point of each group is replaced by the value predicted at the same position by the fitted polynomial.

Order defines the order of the polynomial that will be used for the fitting process.

Window Size determines the amount of sampling points used for every fitting step.

Input data curve (for illustrative purposes, individual input data sampling points are not depicted)

Calculated output data point
A Larger *Window Size* results in more sampling points being considered in the fitting process, hence a smoother curve.

Amplitude of measured spectrum

Filtered function with
Window Size = 5
Order = 2

Filtered function with
Window Size = 21
Order = 2
A higher order allows for more detailed curves, but conversely can also preserve local noise.

Filtered function with Window Size = 21, Order = 2
Filtered function with Window Size = 21, Order = 5
Filtered function with Window Size = 21, Order = 10
Local Noise Filtering
VirtualLab Fusion provides multiple tools to evaluate characteristics of fields, such as FWHM and Maximum detectors.

Through the noise in the measured data those characteristics may be falsified. Filtering the data with the Savitzky-Golay filter can help elaborate the underlying curve and improve the detection of said fundamental characteristics.
Equidistant Resampling

By design, the algorithm keeps the numbers of sampling points constant after the filtering process. For a desired simulation, the number of wavelength samples might be crucial to model an intended optical effect adequately. Therefore, it is possible to resample the result to optimize the numerical effort and accuracy of a potential simulation.
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