**On the use of windowing of THz time-domain spectroscopy signals**

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Terahertz time-domain spectroscopy (THz-TDS) has emerged in recent years as a fundamental tool for the characterization of materials in the electromagnetic frequency range of terahertz (THz) [1]. Consequently, accurate measurement and processing of experimental signals are essential for the precise estimation of physical parameters, such as the complex and real permittivity of the material under study. In recent years, some considerations regarding signal preprocessing have been suggested, albeit without detailed treatment in tutorials or reviews [2, 3]. Among these, the use of zero padding, the truncation of the signal to avoid multiple reflections in certain materials, and the application of windowing to minimize spectral leakage are highlighted. However, none of these works provides a comprehensive algorithm for signal preprocessing, nor a detailed analysis of the impact of each step on the estimation of the physical parameters of interest.

In this work, we propose a preprocessing algorithm for signals measured in a conventional THz-TDS system, along with a detailed analysis of how each processing step modifies the experimental signal, bringing it closer to the expected theoretical behavior. To understand how the application of different spectral windows affects the calculation of optical parameters, such as the absorption coefficient and the refractive index [4], we have theoretically modeled the propagation of a THz pulse generated by an antenna through a material with a linear response. Subsequently, additional effects, such as absorption in air, have been introduced, and the optical parameters have been recalculated by applying windowing, comparing the results with the expected theoretical values. The theoretical and computational results have been validated by applying them to two well experimental cases in the literature: PbTe and GaAs [5,6].

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