Quantitative Characterization of Clock Signals in the Frequency Domain for Signal Integrity Analysis

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Abstract

Signal integrity analysis is usually performed solely in the time domain. The traditional way to include the frequency-dependent elements, like interconnects, is to convolve their impulse response with the input and the other circuit element models to obtain the overall response. This method is inefficient in terms of speed of computation and might lead to stability problems. Therefore, transforming all the specifications of system and signals defined in the time domain to the frequency domain and performing a complete frequency-domain based signal integrity analysis, would simplify and speed up the process and make it effectual. In this paper, the relationship between clock signal deviations in the time domain -for example the undershoot, overshoot, and rise and fall times- and their frequency-domain features was quantified, both numerically and analytically. The proposed models are modeled and simulated in Matlab; whereas a point-to-point communication model is built on Keysight's Advanced Design System to justify these models.

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