Review of: "Pulse Amplitude Measurement Using Low Sampling ADC and Interpolation Technique"

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Potential competing interests: No potential competing interests to declare.

In reviewing the article "Pulse Amplitude Measurement Using Low Sampling ADC and Interpolation Technique," several critical observations emerge from a high-level academic and microelectronics expert perspective. The paper's ambition to efficiently balance system cost and accuracy through the application of interpolation techniques to low sampling Analog-to-Digital Converters (ADC) is noteworthy. However, the exploration and comparative analysis of seven interpolation methods—namely, Nearest Neighbor, Linear, Cubic, LaGrange's, Newton Raphson, Whittaker Shannon interpolation, and Neville's algorithm—although comprehensive, presents several areas of concern and opportunity for enhancement.

Fundamental Concerns:

- The reliance on low sampling ADC combined with interpolation methods raises concerns about the potential to miss rapid signal variations, a critical aspect in applications requiring high-fidelity signal representation. Moreover, while the comparative analysis across seven methods is structured, it does not sufficiently establish the representativeness of these methods for real-world signal behaviors, particularly for non-ideal, more complex signal forms.
- The selection of interpolation methods lacks a deep theoretical grounding, necessary for a comprehensive understanding of their appropriateness in various scenarios. A detailed justification for choosing these specific methods over others could significantly strengthen the paper's foundational aspects.
- The experimental design, particularly the choice of a 1KHz signal for testing, might not fully represent the challenges encountered in higher-frequency applications. This choice could limit the generalizability of the findings to broader applications. Additionally, the formatting errors observed in the equations and the inadequate analysis of figures (notably Figures 6, 7, 8, and 9) highlight a need for more rigorous attention to detail and analytical depth in presenting and interpreting results.
- While the practical implementation of these methods in FPGA and LabVIEW environments is commendable, the analysis of hardware resource utilization is cursory. An in-depth discussion of the trade-offs between computational complexity, power consumption, and real-time processing capabilities would offer valuable insights into each method's practical applicability.

Areas for Improvement:

- An exploration into how each interpolation method copes with noise and signal complexity would enrich the study. This includes a detailed investigation into the impact of noise on interpolation accuracy and the robustness of each method to such disturbances.

- The paper would benefit from a closer examination of software optimizations and algorithmic efficiencies. This could entail a discussion of potential optimizations that could enhance accuracy or reduce resource usage, providing a more nuanced understanding of the algorithms' performance in real-world applications.
- The paper's conclusion could extend beyond summarizing findings to explicitly address the study's limitations and propose directions for future research. This might involve exploring the performance of the discussed interpolation methods across a wider range of applications, examining alternative interpolation techniques, or scaling the methods for higher resolutions or faster ADCs.

In sum, while the article presents a valuable exploration into the use of interpolation methods for pulse amplitude measurement with low-sampling ADCs, a more rigorous theoretical foundation, comprehensive methodological justification, detailed experimental analysis, and a broader consideration of practical implications would significantly enhance its academic relevance and contribution to the field of microelectronics.