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ADCTest Toolbox for MATLAB

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***Abstract* – The IEEE standards for ADC and Digitizing waveform recorder testing (IEEE 1241, IEEE 1057) define the main characteristics of the testing procedures, but cannot determine every detail of them. Implementation of the procedures needs extensive programming and testing of the programs. Moreover, iterative methods need settings of the convergence criteria, maximum number of iterations, etc. Finally, the standards define least squares (LS) fitting, but do not deal with more advanced (however slower) maximum likelihood (ML) methods.**

Therefore, there is a need for software which is readily available, gives reproducible results, is numerically robust, has a graphical user interface, and can compare LS and ML fits. Many engineers and researchers use MATLAB in their work, therefore we decided to develop a tool according to the above requirements. It is available on the web as http://www.mit.bme.hu/projects/adctest/.

I. INTRODUCTION

The ADCTest toolbox is a user-friendly software tool in MATLAB to evaluate measurement data for ADC testing. The main features of the program are the following:

I Processing the measured or simulated data in multiple ways:
- sine wave fit in the time domain in least squares (LS) sense,
- sine wave fit in the time domain, using maximum likelihood (ML) estimation of signal parameters,
- evaluation of measurement record in the frequency domain (FFT test),
- estimation of the static transfer characteristic via histogram test.

II Comparison of results achieved via the standard LS sine wave fit and the alternative ML parameter estimation [1].

III Assembling a measurement descriptor (a complex data set) from raw data (a digital record) and from the circumstances of the measurement. This descriptor can be modified and expanded by the user afterwards.

IV Creating simulated measurement record easily, using a GUI.

The toolbox provides an implementation of widely used test methods like the histogram test or LS sine wave fit according to the IEEE standards [2] [3], and a not yet widely used algorithm, the ML estimation.

The ML algorithm first performs an LS fit and a histogram test [4] to achieve initial parameter estimators (see Fig 1.).

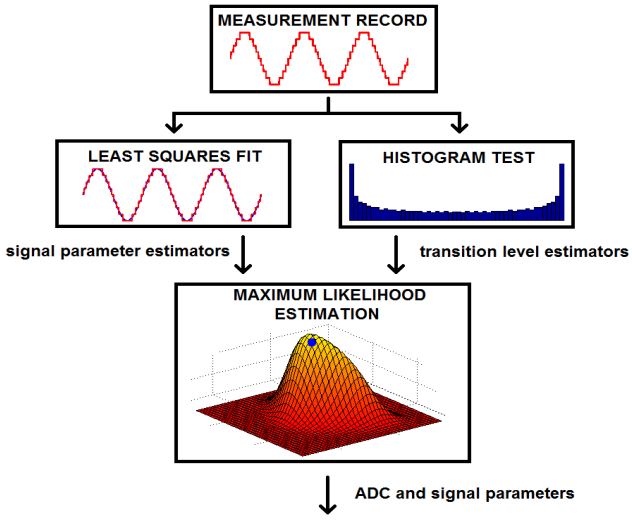

Figure 1. Framework of ML estimation

For each setting of the test methods there is a default option. However, advanced users can customize the methods to meet their needs.

Since two ways of sine wave fitting are implemented in the toolbox, and since ML fit is theortically the "best" albeit slower, it is important to compare the results of them. The estimated sine wave

[1]The presentation illustrates the use of this package on measured or simulated data. It is also possible to work with data previously (by Sep. 12, 2014) sent by email to virosztek@mit.bme.hu (data in text file, as an ASCII vector). Data brought right to the session might also be read if it works smoothly, but there is no guarantee…

parameters can be compared one by one, and overall test results like effective number of bits (ENOB) can be compared as well (see Fig. 2.).

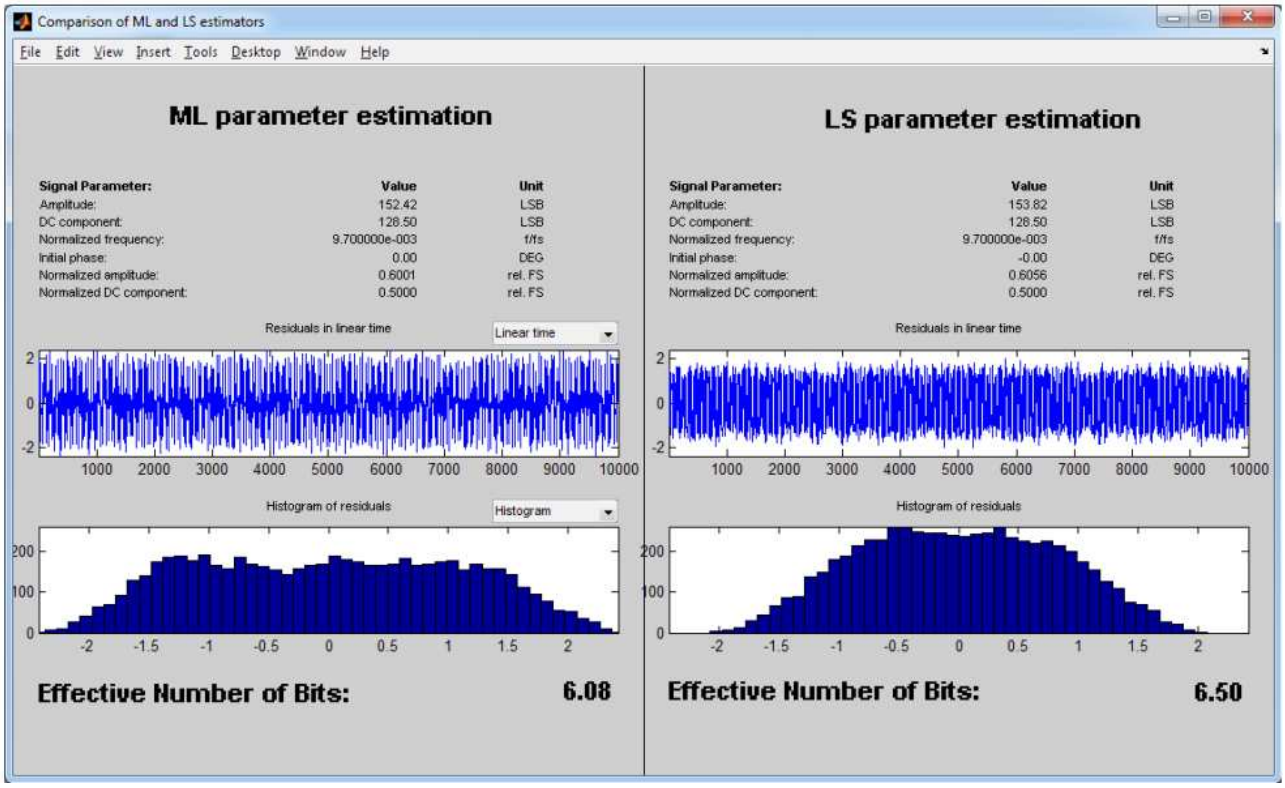

Figure 2. Comparison of results achieved via ML and LS fit.

II. REFERENCES

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