Frequency Response Analyzer  
# The math for robust memory-less analysis #

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This article will explain the math under-the-hood for my implementation of FRA-V5 algorithm for Qspice that I have developed significantly since the initial inception about from end of July 2024 until today 2025 July 30th.

In LTspice (the predecessor of Qspice), has not been implemented for the longest time and most people implement FRA by using “.step” command to perform transient analysis with parameter sweep on the injection signal then using “.meas” command to perform the magnitude and phase extraction based using Fourier series as the post processing. In the April 2023, LTspice have released their built in FRA analyzer, though the exact algorithm is not publicly known (I also have yet to try this).

In Qspice, some people originally used the same .step + .meas as they have been used to with LTspice for long time. However, Qspice introduce a chirp based injection signal FRA method where it can be used with “.bode” command. The calculation in theory is based on FFT to extract the magnitude and phase across the injection frequency range and followed by a some compensation algorithm (that I don’t really understand either). Comparatively, “.bode” is much faster than “.step” + “.meas” anyway it is reported by KSKelvin that it may struggle when the frequency range is greater than 3 decades.

**Ref: <https://forum.qorvo.com/t/frequency-response-analysis-bode-study-guide/15954/10>**

Between the two method, I was unfortunately not really satisfied

There are a few method that can be employed to implement FRA:

1. Fourier transform

This method is used in some hardware FRA, at least its used in Analog Discovery. This method

1. Fourier series
2. Lock-in amplifier