

Magn. Reson. Discuss., referee comment RC2  
<https://doi.org/10.5194/mr-2021-42-RC2>, 2021  
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## **Comment on mr-2021-42**

Anonymous Referee #2

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Referee comment on "On the modeling of amplitude-sensitive electron spin resonance (ESR) detection using voltage-controlled oscillator (VCO)-based ESR-on-a-chip detectors" by Anh Chu et al., Magn. Reson. Discuss., <https://doi.org/10.5194/mr-2021-42-RC2>, 2021

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General comments:

The paper presents a detailed analysis of the amplitude sensitive ESR detection using VCO based detector. In this method the amplitude of the oscillator is monitored to detect the ESR signal unlike the common method where the change in frequency is used to detect the ESR signal. Similar analysis was done for oscillator frequency change detection method, previously reported by the authors. Though the method is not new, a detailed analysis of the setup using circuit simulations and the comparison of simulated and measured outcome is noteworthy. It is also important to note that the amplitude sensitive detection allows for simplified signal detection setup compared to the frequency detection setup especially when the frequency modulation may be required to enhance the signal to noise ratio.

The previous work on the amplitude sensitive detection by Matheoud is mentioned by the authors but a simple comparison of the previous work and the work detailed in this paper will have some value (like SNR comparison and mention of HEMT and CMOS technologies).

Specific comments:

Page 4, line 90 : define slope factor ( something like transistor characteristic dependent parameter)

Page 5, line 98 :  $v_d$  and  $A_{osc,0}$  is not defined. Defining this here would help understanding eq 8 better where  $A_{osc,0}$  is when there is no ESR.

Page 6, line 121 : remove "also" from " also on the coil inductance....."

Page 6, line 131 : see Page 5, line 98 comment

Page 6, line 142 : remove "away" from " system far away from"

Page 8, line 196 : The equation is missing  $\omega_{osc}$  on the right hand side.

Page 9, line 203 : insert "with respect to B1 and Wosc" after "derivatives of eq. (17)

Page 9, line 204 : insert " respectively" after " oscillation frequency wosc.."

Page 9, line 205 : mention of eq 4(b) to obtain eq 18 will be useful

Page 9, line 213 : line " where Nspins is the number of spins in the sample and SNROpt is the optimum SNR achievable with said number of spins for" is awkward maybe just "where Nspins is the number of spins in the sample for SNROpt" is better ???

Page 10, line 236 : mentioning or equating eq. 24a to frequency for ESR would be helpful to connect the dots between the circuits model and analytical model

Page 10, line 238 : define K (coefficient of coupling)

Page 11, line 241 : remove and before " therefore one parameter can be"

Page 11, line 246 : what is CR analysis is it a function in the simulator?

Page 11, line 253 : replace "said" with "the" in " part of said susceptibility"

Page 11, line 254 : mentioning section 4 in this line would help the reader go back to the

section to understand the effect of Qcoil on the imaginary part of the susceptibility

Page 15, line 323 : replace "where" with "were" in "The analytical models were then used..."