NEWTON Project: New opportunities for magnetic surveys in the planetary exploration

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Abstract:
NEWTON project aims to develop a new multisensory instrument to measure the real and imaginary susceptibility of rocks and soils at different frequencies in contrast to other commercial devices [1].

In order to achieve this, the head of the sensor is a resonant circuit with an open autoinductance “L”. The susceptibility is measured by the change in the L due to the closure of the gap when a rock approaches the head. A first prototype has been conceived to be part of a surveying system (Fig. 1) in which the head is approached to the rocks during the tracks and therefore there is no need to load the samples, which simplifies the prospections. A latter prototype will be developed for near future planetary rovers as part of the geological suites.

Figure 1.- Surveying system where NEWTON first prototype will be integrated.

Since in both cases the power of the systems is limited, the circuit is based on a modified tank circuit (Fig. 2), which has a resonance frequency that minimises the power consumption from the power supply achieving intense currents in resonance in the autoinductance.

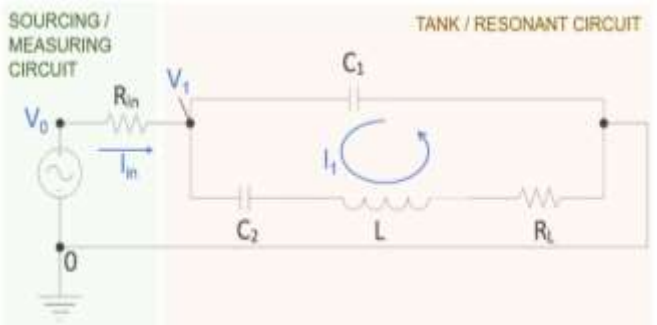

Figure 2.- Modified tank circuit sheme.

One of the concerns of the circuit is to achieve a sufficiently intense and extensive stray field in the L to penetrate the samples and magnetize them avoiding the effect of their surface roughness. In relation with this respect, a discussion is made regarding the different topologies of autoinductance used (H, C, and 8 shapes) paying attention to the intensity of the flux lines and the produced stray field.

The other question is how to vary the resonance frequency avoiding the switching among different branches of tuning capacitors. In this device, this goal has been achieved by means of magnetic amplifiers [2]. At his point, different architectures are shown, and their characteristics described.

The degree of consecution of the objectives and the miniaturisation levels reached [3] together with the potential to include such capability in the geological modules of planetary rovers present a very attractive scenario for missions such as Martian Moons eXploration (MMX) or Mars sample return missions.

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