**AN IMPROVED HIGH-SENSITIVITY BROADBAND MAGNETIC RESONANCE SOUNDING COIL SENSOR WITHOUT SIGNAL DISTORTION FOR GROUNDWATER DETECTING**

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The magnetic resonance sounding (MRS) technique is a noninvasive geophysical method and could provide unique insights into hydrologic properties of groundwater. The coil sensor is the preferred choice for detecting the weak MRS signal because of its high sensitivity, low fabrication complexity and inexpensiveness. Currently, there are mainly tuned and non-tuned configurations for the coil sensor design. In the case of the tuned design, high sensitivity is its main advantage, but the signal may be distorted because of the narrower bandwidth and the data acquired using this sensor can hardly be used in the post digital signal processing methods, such as adaptive noise cancelling of multichannel MRS instrument which is the most commonly used method for improving signal to noise ratio (SNR). In the case of the non-tuned design, the sensor can obtain valid signals and facilitate the post digital signal processing due to the broadband, but the sensitivity decreases compared with the former. To circumvent this contradiction, we chose a method of adding a LC broadband filter in parallel with a matching capacitor between the pickup coil and the preamplifier. Based on the characteristics of the pickup coil, the matching capacitor is calculated to increase the gain in the passband of the passive filter and improve the sensitivity of the sensor system. Moreover, the effect of the MRS applications is often influenced seriously by power harmonic noises in the developed areas, especially low frequency harmonics which always cause the coil sensor nonlinear distortion. Experimental tests in the laboratory show that the new coil sensor not only improves sensitivities of the MRS instrument but also inhibit the signal distortion by suppressing power harmonic noises in the strong electromagnetic interference environment. The new sensor system will provide a new idea for the wider application of the MRS.