

4.4.5. GPR-ELECTROMAGNETIC SENSOR ARRAY DATA FUSION

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In principle, soil comprises three components: sand (2.0 mm diameter to 0.05 mm) that is primarily a quartz mineral but can include feldspars and other small rocks and mineral particles; silt (from 0.05 mm diameter to 0.002 mm) is also mostly quartz and is often more angular; and clay (mineral materials smaller than 0.002 mm diameter) usually consisting of secondary clay minerals. Typically, the soil density value is about $0.9 - 1.8 \text{ g/cm}^3$ with a median value of 1.3 g/cm^3 . An important property of soil is salinity, measured by the electrical conductivity. Thus, if the conductivity is greater than 4 S/m , it indicates a severe accumulation of salts, which restricts the growth of most vegetables and plants, if it is between 2 S/m and 4 S/m , the soil has an average accumulation of salts and the growth of vegetation is not restricted but it requires frequent irrigation. In the same time, metallic objects can exist in the soil, buried and may contain unexploded ordnances and landmines.

A series of electromagnetic methods have been developed for the determination of soil condition: ground penetrating radar, which operates in $100 \text{ MHz} - 22 \text{ GHz}$ frequency range; tomography methods using more generators and receivers of electromagnetic field inserted in boreholes in soil, the time of flight being measured using the Q-transform; broadband electromagnetic induction method using a transmitter coil excited by a low frequency alternate current and a small diameter receiver coil placed in the center of the transmitter (monostatic mode), or at a certain distance (bistatic mode). In both cases a complex system of two concentric transmitter coils, connected in series with diameters have been chosen in order that on a common axis the magnetic field would be null.

This work presents data fusion method between data delivered by:

- a) GPR with 400 MHz frequency;
 - b) Electromagnetic system, send-receiver type using a sensor array for detection [1].
- The data fusion method is based on the evidence theory presented in [2].

Using this procedure, an improving of the detection of probability and, simultaneously, a decreasing of the probability of false detection are obtained.

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References:

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