

# Detection of Moisture in the Soil Using Microwave

Nuthan N, Pranav Kumar Eranti

Atria Institute of Technology, ASKB Campus, Anand Nagar, Bengaluru – 560024

**Abstract:** *This paper explains about the determination of soil stability for farming using microwave analysis. This uses a low cost microstrip patch antenna. This works on the principle of increase in dielectric constant if there is an increase in moisture. This works because of the high dielectric constant of water. And by knowing the type of soil and its moisture content the crops can be suggested suitably.*

**Keywords:** *Microwave; Strip antenna; agriculture; moisture; soil.*

## I. INTRODUCTION

Agriculture is the most important sector and it depends on the soil, atmosphere and water. The water should be accusable to the root level of the crops and this depends on water retention of the soil than the frequency of the rainfall. This helps us to know the budget of water needed, it is also used to find the time and place to grow crops. It also helps in civil and soil engineering and various purposes. This uses a microwave sensor which is simple, durable, small and highly sensitive which is used to determine and increase the soil performance. The sensor measures effective dielectric constant of the soil and hence the moisture in the soil can be known.

## II. TECHNIQUES

There are few methods to measure the moisture in the soil. There are direct method and indirect method. The direct method is also called destructive method as it may harm the crop in that process. The direct sampling can be achieved by evaporation, leaching and the chemical process and calculated accordingly. The indirect method which is also called nondestructive method uses sensors which is kept on the soil sample and determine the moisture level of water. It requires calibration, less resources and highly accurate and can be matched with the similar soil samples.

## III. MEASUREMENT OF DIELECTRIC PROPERTIES

There are various techniques used to determine the properties of solids and semi-solids. It can be achieved by these mediums namely co-axial cables, free space, waveguides and transmission lines. Transmission line method does not need any special preparation it's easy to know the dielectric properties of soil. The ionic conductivity becomes negligible compare to dielectric losses from this procedure the water content present is measured furthermore the dielectric primitivity is higher

than the soil contents. The moisture is varies and the readings are taken.

## IV. SENSOR DESIGNS

The antenna sensors are used and hence the calculations are easy to perform and the modeling of the antenna is complex as it has to interact with moisture and the soil and hence should be made rigid. The antenna is made to resonate at 2.45 GHz and simulated by HFSS. The simulated return losses are 20.2806 dB.

### A. Measurement Of Dielectric Properties

The soil samples are collected and baked in the oven for 8 hours at 100 degrees Celsius and the moist and the dry weights are measured finding out the moisture content in the soil and the moisture samples vary from 9.122-16.02.

## REFERENCES

- [1] Lakhvinder Singh Solanki, Surinder Singh, Determination of Soil Suitability for Agriculture Farming Using Microwave Analysis, Name of the conference, City of Conference, Abbrev.
- [2] Soil moisture detection algorithm at X-band. Synthetic Aperture Radar (AP SAR), 2011 3rd International Asia-Pacific Conference. 26-30 Sept. 2011
- [3] Yisok Oh, Soon-Gu Kwon, Ji-Hwan Hwang Department of Electronic Information and Communication Engineering, Hongik University, Seoul, Korea
- [4] Soil Moisture Detection Using Electrical Capacitance Tomography (Ect) Sensor Imaging Systems And Techniques (Ist), 2011 Ieee International Conference On 17-18 May 2011
- [5] Nurzharina Binti Abd. Karim, Idris Bin Ismail Electrical and Electronics Engineering Department, Universiti Teknologi PETRONAS, 31750 Tronoh, Perak Darul Ridzuan, Malaysia
- [6] Detection of soil moisture content changes by using a single geodetic antenna: The case of an agricultural plot. Geoscience and Remote Sensing Symposium (IGARSS), 2015 IEEE International. 26-31 July 2015.
- [7] N. Roussel, F. Frappart Université Paul Sabatier, 31400 Toulouse, France
- [8] Real Time Detection Of Soil Moisture And Nitrates Using On-Board In-Situ Impedance Spectroscopy.
- [9] Systems, Man, and Cybernetics (SMC), 2013 IEEE International Conference on. 13-16 OCT 2013.
- [10] Gunjan Pandey, Ratnesh Kumar, Robert J. Weber Dept. of Electr. & Comput. Eng., Iowa State Univ., Ames, IA, USA
- [11] T. Kalaivani, A. Allirani, P. Priya A Survey On Zigbee Based Wireless Sensor Networks In Agriculture. Trendz In Information

Sciences And Computing (Tisc), 2011 3rd International  
Conference On 8-9 Dec 2011

- [12] General Purpose Self-Tuning Capacitance Sensor [For Oil Recycling And Soil Moisture Measurement Application] Instrumentation and Measurement Technology Conference, 1998. IMTC/98. Conference Proceedings. IEEE. 18 – 21 May 1998.
- [13] Q. Smit B.J.P. Mortimer J. Tapson Centre for Instrum. Res., Cape Technikon, Cape Town, South Africa
- [14] Device for multiple environment parameters measurements for agriculture use. 2014 IEEE 20th International Symposium for Design and Technology in Electronic Packaging (SIITME)
- [15] Ioan Plotog, Gaudentiu Varzaru, Bogdan Mihailescu Center for Electronic Technology and Interconnection Techniques, Politehnica University, UPB - CETTI, Bucharest, Romania