PREFACE

Remote sensing is the process of acquiring information about the objects that are present on or off the earth without coming in their contact. A physical carrier is required to carry the information from the object to the sensor through an intervening medium. The electromagnetic spectrums from low frequency waves through microwaves, infrared, visible rays are used for information carrier in the remote sensing. The information acquired in different regions of spectrum is complementary to each other. However, Microwave has certain advantages over the visible and infrared region.

For the remote sensing application, the microwave is the better choice due to its unique capabilities like all weather and all time operation, sensitivity to soil moisture and ability to penetrate soil and vegetation medium etc. In case of active microwave remote sensing, the information about dielectric constant (electrical properties of the object), geometry (geometrical properties of the object) and scattering coefficient are useful for developing the theoretical, empirical and semi-empirical models for acquiring the information about target of interest.

Nowadays, microwave remote sensing technology is considered as a powerful tool for the crop signature and soil moisture studies. In order to use microwave remote sensing technology to monitor the crop growth condition, it is necessary to relate the scattering coefficient to crop growth parameters. The spatial and temporal monitoring of soil moisture of agricultural area is very important to schedule the irrigation management timely and more effectively.

The active microwave remote sensing measurement is performed based on two type of configurations either monostatic or bistatic. The radar measurement in bistatic configuration provides the multi dimensional information about the land surface. It provides additional information than the monostatic configuration about the target of interest.

Several researches have used monostatic configuration for studying the scattering mechanism of microwave with crop/vegetation and soil. Very limited research based on bistatic scatterometer has been reported till date. Recently, a space

mission has been started by German Space Agency, with twins satellite (TanDEM-X and TerraSAR-X) for bistatic radar to generate a three dimensional image of the earth.

There is complex interrelationship between the system and target parameters and the difficulty of making enough accurate measurement of the various parameters in experimental studies. However, significant correlation exists between scattering coefficients with soil surface parameters, plant height, leaf area index, plant biomass, plant water content. Various researchers have developed inversion algorithms for establishing relationship between scattering coefficient with the crop growth variables and developed models using their radar data as input data.

Modeling in agriculture has been widely used to monitor various soil and crop growth variables by estimating soil surface and crop growth variables at various growth stages of the crops. Therefore, the model free estimation techniques like artificial neural network (ANNs), fuzzy logic (FL), support vector machine (SVMs) etc. are capable of providing the best results in the retrieval of soil/crop variables using radar data. The ANNs have become a popular tool in the analysis of remotely sensed data mainly due to their widely demonstration abilities. The ANNs have been reported to perform more accurately in many areas such as statistical classifiers, particularly when the problem taken is complex and the source data have different statistical distributions. The ANN may be used to classify remotely sensed data more accurately than maximum likelihood or others techniques such as regressions or decision tree approaches.

In the present work, the bistatic scatterometer measurement were carried out to analyze the microwave response of soil/crop growth parameter and estimate the soil moisture from slightly rough soil surfaces and crop growth variables of four different crops using ANN at various growth stages.

The bistatic scatterometer measurements are carried out to investigate the microwave response of soil surfaces having different soil moistures of slightly rough surfaces. An outdoor crop bed of rice crop, kidney bean crop, wheat crop and chickpea crop are specially prepared for the bistatic scatterometer measurement in the angular range of incidence angles 20° to 70° at HH- and VV- polarizations for X-band. The bistatic scatterometer and crop growth variables are measured simultaneously at their various growth stages. The angular variations of bistatic

scattering coefficient for the above-mentioned crops are computed and analyzed the microwave response of crop/soil parameters for both HH- and VV- polarization. The potential of ANN algorithm is used for the estimation of the soil moisture and crop growth variables using bistatic scatterometer data.

The present research work would be able to monitor the growth of agricultural crop by estimating the various crop/soil parameters and to predict the sensors parameters for space borne and air borne more authentically through ground truth observation using various soft computing techniques. Further, it will fortify the clear understanding of remote sensing application for various purposes, be it the design of sensors, crop classification, crop-yield and soil moisture estimation or agricultural planning.