ACKNOWLEDGEMENTS

I would like to express my deep sense of gratitude and indebtedness to Dr. G. RAMACHNDRA REDDY, Professor in ECE, Department of EEE, SVU College of Engineering, Tirupati and Dr. K. SATYAPRASAD, Professor, Department of ECE, JNTU College of Engineering, Anantapur under whose guidance this thesis work had been carried out. Mere words would not be sufficient to place on record the erudite guidance, sustained encouragement, constructive comments and inspiring discussions with them during course of this work. I consider myself to be fortunate to have worked under them. They in fact have been the source of inspiration for this work. It has been privilege and pleasure working under their guidance and it has been an experience, which I shall cherish for a longtime.

I express my profound thankfulness to Prof. K. Satyanarayana Reddy, Principal, Dr. C.S. Reddy former principal and Management of KSRM College of Engg., Cuddapah for permitting and extending me their co-operation in carrying out this research work.

I specially thank Dr. D. Narayana Rao, Director and Dr.V.K. Anandan, NMRF, MST Radar center, GADANKI, Tirupati, for providing necessary Atmospheric data for carrying out this research work.

I would like to thank Dr. P. Dhananjaya Rao, Principal, JNTU College of Engg., Anantapur for according the necessary permission to carry out my thesis.

I would like to thank Dr. K. Soundararajan, Professor, Dept of ECE, JNTUCE,ATP for his constant encouragement and timely suggestions.
I owe my gratitude to C. NageswaraRaju, Prof. N.K. Swamy, Prof. V. Madhusudhan, Dr. B. Sudheer Prem Kumar, S. VaradaRajan, M.N. Giriprasad, T. Subramanyam and all my colleagues at KSRMCE Cuddapah for their help, encouragement and continuous inspiration to carry out this work.

My respectful thanks to my parents Sri T. Rajaguru and Smt. T. Lakshmamma and my Brother-in-law Sri B. Mallikarjunudu and my sister Smt. B. Lakshmi Devi for their love, concern and encouragement.

But, most of all, I extend my warm thanks to my wife Varalakshmi and my sons, Satish and Kishore and my sister's sons Raghu and Kiran who have contributed their patience and understanding.

Finally, I would like to thank one and all who have directly or indirectly contributed for the successful completion of my thesis.

T. JAYACHANDRA PRASAD
Processing of signals either in time domain or in the frequency domain is well established. Second order statistics of Complex random signals are usually described by Covariance function. In some cases, covariance function is not sufficient to completely describe second order statistics of complex random signals. For this purpose a new moment called Relation function is used. This thesis aims at processing of complex random signals using Relation function and Group delay functions. The concept of Relation function and its properties have been presented. Spectrum estimation of complex signals using Relation function and group delay functions (combination of Magnitude and Phase group delay) has been proposed. It is clearly established that pole or zero of a complex system can be uniquely determined by Relation function approach. The concept of analytical signal spectrum estimation based on Relation function and group delay function has been presented. It is shown that even at low signal to noise ratio conditions spectral components of analytical signals can be clearly estimated with high resolution. The concept of Relation function has been extended to estimate the spectral components of first and second order dynamical systems. The concept of estimating wind profiles based on Relation function and group delay functions has been proposed. To check the superiority of Relation function, results obtained based on the proposed technique have been compared with that of covariance function approach.