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To my family

ACKNOWLEDGEMENTS

First of all I would like to thank my alma mater, Florida State University for giving me this opportunity to pursue graduate studies. I am ever so grateful to my advisor, Prof. Frank Gross for making time for me, for his infinite patience and for showing me the right direction whenever I got lost during the course of this research. I would also like to thank my committee members for their invaluable inputs. Also, this research would not have been possible without the help of my friends with whom I have spent hours of brainstorming sessions during the course of this research.

Last but not the least, I cannot thank my parents enough for their unselfish support and encouragement, without them I could not have reached this stage in life.

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ABSTRACT

In recent years there has been an explosive growth in the number of wireless users, particularly in the area of mobile communication. In future, wireless mobile systems will be more sophisticated and more widespread. This growth has triggered an enormous demand not only for capacity but also better coverage and higher quality of service. Several new technologies have been explored and deployed in this regard to make effective use of the limited resources. Space Division Multiple Access (SDMA) has emerged as a key technology and holds a lot of promises for the future of mobile communication. SDMA exploits the spatial domain of the mobile radio channel to bring about an increase in network capacity in the existing wireless systems. Unlike wireless systems in the past, which used fixed antenna systems, SDMA based systems uses smart antennas or adaptive arrays that are dynamically able to adapt to the changing traffic requirements. Smart antennas, usually employed at the base station, radiates narrow beams to serve different users. As long as the users are spatially well separated, the same frequency can be reused even if the users are in the same cell. This additional intra-cell channel reuse based on spatial separation is the key in achieving an increase in the capacity of the system.

The aim of this study is to understand different smart antenna approaches, most importantly have a thorough understanding of a fully adaptive beamforming approach based on smart antennas. Various adaptive algorithms used to compute the complex weights are investigated. This includes a detailed study of algorithms like the Least Mean

Least Squares (LMS) algorithm and the Sample Matrix Inversion (SMI) algorithm. The thesis also presents a hybrid adaptive algorithm based on the combination of two algorithms: SMI and LMS.