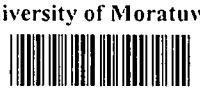
University of Moratuwa

Capacity Improvement of CDMA Systems by Adaptive Beam forming using GRNN Techniques.

Submitted in partial fulfillment for the degree of
Master of Engineering in Electronics and Telecommunications



C. S. Jayawardena

August 2003

DEDICATION

To my loving parents...

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ABSTRACT

The objective of this work is to demonstrate a method of improving the capacity of a Code Division Multiple Access (CDMA) system by employing Neural Network based Adaptive Beamforming. A Generalized Regression Neural Network was used for this purpose.

First, the Neural Network was designed, which could accurately predict the phase angle of the feed current to a ten-element antenna array in order to form a directional beam towards a given signal source direction while forming a null towards a given interfering source. Then, the model was developed to form multiple beams towards different signal sources.

Next, using the multiple beamforming technique, a new Space Division Multiple Access (SDMA) model was developed to improve the capacity of an existing CDMA system that has already become saturated. This SDMA model is based on the statistical distribution of the mobile users within a sector. It assumes that the user distribution within a sector is non-uniform. More densely populated areas within a sector are identified and the users in a particular area are grouped together. One such group is called a cluster. Similarly, a number of clusters are selected and the three most populated clusters are served with three isolated directional beams operating on the same frequency achieving SDMA.

It was observed that this new SDMA model could improve the capacity of existing CDMA systems up to a maximum of 20% with three directional beams.

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LIST OF ABBREVIATIONS

CDMA	Code Division Multiple Access
DOA	Direction of Arrival
DSSS	Direct Sequence Spread Spectrum
FDMA	Frequency Division Multiple Access
GRNN	Generalized Regression Neural Network
PCS	Personal Communications Services
PN	Pseudo Noise
RF	Radio Frequency
SDMA	Space Division Multiple Access
SINR	Signal to Interference and Noise Ratio
TDMA	Time Division Multiple Access