

Chapter One

Introduction

1.1 Preface

Cellular communication networks are continuously evolving to keep up with the rapidly increasing demand for wireless data services. Higher area throughput has traditionally been achieved by a combination of three multiplicative factors [1], more frequency spectrum, higher cell density (more cells per km²), and higher energy efficiency. Massive MIMO (also known as Large-Scale Antenna Systems, Very Large MIMO, Hyper MIMO, Full-Dimension MIMO) makes a clean break with current practice through the use of a very large number of service antennas (e.g., hundreds or thousands) that are operated fully coherently and adaptively. Extra antennas help by focusing the transmission and reception of signal energy into ever-smaller regions of space. This brings huge improvements in throughput and energy efficiency, in particular when combined with simultaneous scheduling of a large number of user terminals.

1.2 Problem definition

During the last ten years data traffic has seen a massive growth in the number of connected wire-less devices (Smartphone, tablets, laptops, and many other wire-less data consuming devices). Billions of devices are connected and managed by wireless networks. At the same time, each device needs a high throughput to support applications such as voice, real-time video, movies, and games. MU MIMO antenna is introduced which has advantages over conventional MIMO as it works with cheap single antenna terminal, it works in parallel & without interference, it simplifies resource allocation because every active terminal utilizes all frequency bits but, it creates a rich scattering

environment which we don't require moreover, it requires equal number of service antennas and terminals which is not scalable technology.

1.3 Objectives

The objectives of this thesis are:

- ✓ To Study and Modeling massive mimo system.
- ✓ To Simulate and Implement massive mimo.
- ✓ To Evaluate the massive mimo system.

1.4 Proposed solution

Massive MIMO is the best solution till now, it requires extra antennas (hundreds to thousands) in the base station to serve simultaneously large number of terminals in the same frequency resource, by focusing energy in smaller regions of space to bring huge improvement in throughput and radiated energy efficiency, it improves the effective SNR and it can increase the capacity 10 times or more and simultaneously, the full advantages of the massive MIMO system can be exploited using narrow beam forming strategies such as maximum ratio transmission (MRT) or zero forcing (ZF). To achieve these benefits of massive MIMO, accurate CSI must be available perfectly. However, in practice, the channel between the transmitter and receiver is estimated from orthogonal pilot sequences which are limited by the coherence time of the channel. Most importantly, in a multicell setup, the reuse of pilot sequences of several co-channel cells will create pilot contamination.

1.5 Methodology

First a literature review will be conducted. The implementation of massive MIMO system model will be performed using the MATLAB software program. The next step is to analyze the performance of massive MIMO according to ZF and MRC processing in single cell and multicell scenario.