Intelligent Closed Loop Power Control For Reverse Link CDMA System Using Fuzzy Logic System.

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Abstract **- In wireless communication systems, multiple-access techniques introduce multiple access interference and which is one of the major factor that limit the system capacity. For CDMA/WCDMA systems, power is the main resource that is shared by multiple access schemes and thus the performance relies greatly on fast and accurate adaptive power control for both mobile and base stations. This work presents the intelligent closed loop power control for reverse link CDMA using fuzzy logic system.**

***Index term*: power control, CDMA, Fuzzy logic.**

I.INTRODUCTION

Multiple users occupying the same band by having different codes is known as CDMA - Code Division Multiple Access system. Power is a fundamental concept in wireless communication systems, the received power is the signal strength to the desired receiver and is interference to all other receivers, the task of power control lies not only in maintaining desired link quality, but also in minimizing interference to others. A mobile station without power control can create enough uplink interference level at the base station to block any other user from accessing the network.

II.CDMA/WCDMA .

Multiple users occupying the same band by having different codes is known as CDMA - Code Division Multiple Access system. It is based on direct sequence spread spectrum. CDMA is both an access method and an air interface method. with CDMA ,all the user data and in most implementation the control channel and signaling information ,are transmitted at the same frequency at the same time. All the CDMA system employ direct sequence spread spectrum and powerful error control codes .CDMA improves quality of voice by using a better voice coder. Although CDMA does provide an inherent flexibility for multimedia traffic. This disadvantage lies in the necessity for power control and implementation complexity. CDMA goal is to

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maximize the number of simultaneous users. There are two channel used in CDMA.

I. Forward channel
II. Reverse channel

III.CDMA/WCDMA POWER CONTROL.

As CDMA is a multiple access system in which several users (mobiles) have access to the same frequency band, the received signal strength will be different for different mobiles, resulting in near-far interference. Here, near-far refers to the ratio of signal strength from a near mobile to the signal strength from a mobile that is far away. This is critical also for WCDMA because the same frequency is shared by many mobiles PC helps to reduce co-channel interference, this increasing the cell capacity by decreasing interference and prolonging the battery life by using a minimum transmitter power.

Generally, the PC schemes are divided into *distributed* an *centralized* techniques. In distributed power control (DPC), mainly the users received SIRs are used by BS to iteratively adjust the transmitted powers so that all users finally meet the Quality of Service (QoS) requirements. In order to maximize Capacity and QoS, MS transmissions should be received at the BS with equal power. In centralized power control(CPC), all information about the users channels are collected in a central unit which determines the properly transmit powers for each user.

Power control algorithm falls into two categories:

I. received power strength based
II. SIR based

TYPES OF POWER CONTROL

I. Open loop power control
II. Closed loop power control

↙ ↘

Inner loop **outer loop**

OPEN LOOP POWER CONTROL:

Open loop PC has been employed to combat path loss and shadow fading**.** In the absence of dedicated channel, OLPC is used though closed loop power control gurantees the adequate transmission of power by the user in order to attain service needs for a specific dedicated link. Here the transmit power is inversely proportional to received signal strength.

CLOSED LOOP POWER CONTROL:

CLPC is utilized to assure whether the user transmits sufficient power to satisfy service needs.

NEED FOR POWER CONTROL:

Since the capacity of WCDMA is interference restricted, the capacity will decrease when the number of users in the WCDMA system is increased. In order to maximize the system capacity, it is vital to minimize the interference in the systems. The transmission power from additional users in the uplink is one of the vital sources of interference. A mobile nearby the base station may transmit excessive power, the transmission power in the uplink is not appropriately regulated resulting in large interference to the further users connected to the same base station. This condition minimizes the capacity of the system and thus it is essential to organize the transmitted power.

In CDMA, its performance gets directly affected since the system power control has a strong effect on the interference experienced by the receiver. The main characteristics of power control are compensation of fading channels and changes in the transmitted powers of interfering users. On the other hand, it might cause problems on the adaptation of equalizers. power control mechanism that assures that the received power levels from all User Equipments(UE) are identical at base station prevents the above issues .

The fundamental idea of power control mechanism is handling the minimum requirement for the Quality of Service (QoS) of the channel and to maximize the minimum Signal to Interference Ratio (SIR) in each of the channels in the CDMA system .Therefore power control is seen as an important method to reduce mutual interference between the users, at the same time compensating for time varying propagation conditions. This also decreases the transmission power and maximizes the system capacity.

IV.WHAT IS NEAR-FAR PROBLEM

It is a condition in CDMA based system in which two transmitter one close to the BS and other for from the BS. Transmit at the equal power but the signal received from the closer transmitter has higher SNR(good) while the signal received from the far transmitter has low SNR(bad) at the receiver(BS).

Some time the receiver cannot detect the weaker signal receiver from the far transmitter if the SNR is very low and below the detectable range. Here In order for receiver to receive the signal from the for transmitter will have to increase the transmit power between this will cause more noise and lower SNR to other users for from this transmitter.

The near for problem is a condition in which a receiver captures a strong signal and thereby makes it impossible for the receiver to detect a weaker signal.

WHY THE NEAR FAR PROBLEM PRESENT IN CDMA,NOT IN GSM?

In CDMA the UE share transmission Frequency and transmission time in CDMA based system hence they have this problem. But in GSM ,the UE also share the signal carrier frequency in all but transmit at different times since each user is allocated at time slot for transmission.

EFFECT OF NEAR-FOR PROBLEM

- Channel capacity
- Service degradation
- Battery drain

V.EXISTING METHOD:

The neural network was trained using Backpropagation learning algorithm to find optimum weight matrix and then optimized weighted value is used to reduce the error level. The reduced error level increases the efficiency of the SIR-based power control system.

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VI.PROPOSED METHOD:

Introduces a new application of fuzzy-logic control (FLC) to power control in a DS/CDMA cellular system over mobile fading radio channels. This conventional feedback power control algorithms allow the base station to send a power command to raise/lower each user transmitting signal power level by a fixed power step and then keep the received powers almost equal. Then the fixed-step approach is actually an integral control whose power increment is determined according to the bang-bang-like control policy. This control scheme suffers from several disadvantages. To tackle these difficulties, a fuzzy proportional-plus-integral (PI) control, here input variables are the received power error and error change, it introduced to determine each user's transmitting power in order to maintain simultaneously all users' signal power received at the base station nearly equal and to achieve better system stability and control performance. This derivation of the fuzzy PI control has been carried out by analyzing both the closed-loop steady state behavior and transient response of the system with a priori knowledge of the dynamics of the CDMA mobile fading channels.fuzzy control, linguistic descriptions of actions in controlling a process are represented as fuzzy rules. The fuzzy-rule base is used by an inference mechanism in conjunction with some knowledge of the states of process in order to determine control actions.here, These actions would lead to the fast rise time,small root-mean-squared (rms) tracking error and minimum overshoot . Thus the Additional advantages of fuzzy PI control over conventional control theories are discussed.

BLOCK DIAGRAM:

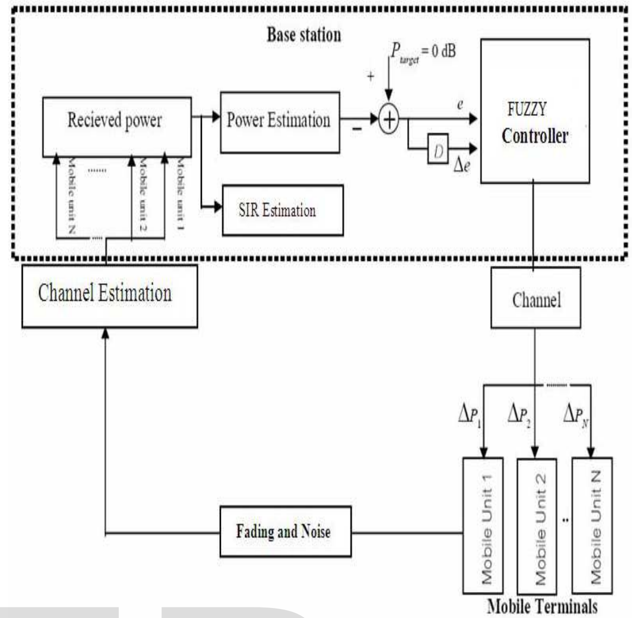

Fig 1:block diagram of fuzzy controller.

FUZZY CONTROLLER:

The fuzzy controller comprises four principles.

- Fuzzification interface.
- Fuzzy rule base.
- Defuzzification interface.
- Interference engine.

The fuzzification interface-it converts the input values of both the error and error change into suitable linguistic values that may be viewed as terms of fuzzy sets.

The fuzzy-rule base comprises a knowledge of the application domain and the attendant control goals and It consists of a fuzzy data base and a linguistic (fuzzy) control-rule base. The fuzzy data base is used

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to define linguistic control rules and fuzzy data manipulation in FLC. The control-rule base characterizes the control goals and control policy by means of a set of linguistic control rules.

The inference engine is a decision-making logic mechanism of FLC**.** It has the capability of simulating a mobile radio channel based on fuzzy concepts and of inferring fuzzy control actions employing fuzzy implication and the rules of inference
in fuzzy logic.

The defuzzification interface converts fuzzy control decisions into crisp, nonfuzzy (i.e., physical) control signals. Here these control signals are applied to adjust the level of power step in order to equalize the signal powers of all users received at a base station.

VII. SIMULATION RESULT:

Here the intelligent closed loop power control in reverse link CDMA by using Fuzzy logic controller was simulated by using matlab code and the power is controlled and the error level was reduced by using SIR estimation and power estimation.

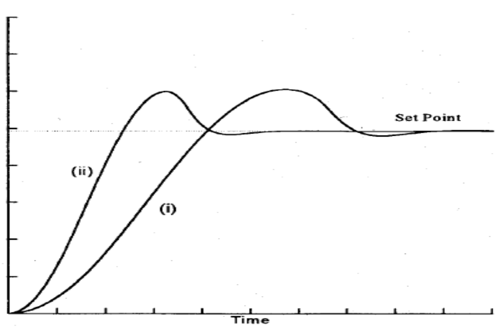

Fig 2: verbalized fuzzy PI control responses.

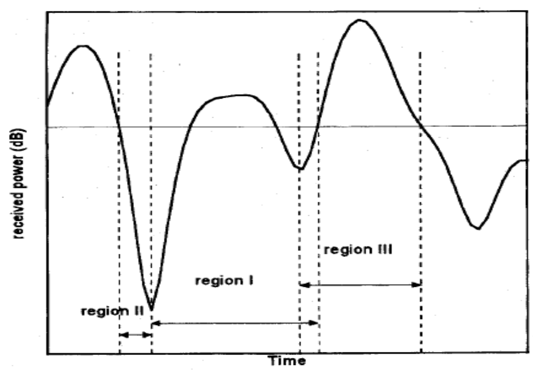

Fig 3: A typical fading power signal.

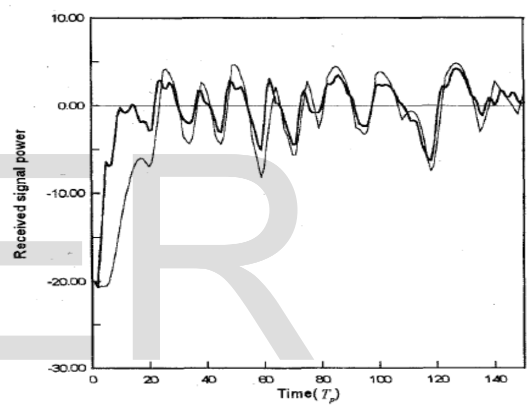

Fig 4: wave form of the received signal achieved by the fuzzy PI contol.

VIII.CONCLUSION:

This paper has introduced a feedback power control, based on fuzzy-logic theory, which is capable of maintaining for all users nearly equal signal power received at the base station over the CDMA mobile radio channels. The fuzzy PI control has been derived by analyzing both transient step response and steady-state behavior of the CDMA fading process. the fuzzy PI control can achieve a faster rise time, small overshoot, and better rms tracking error than the fixed-step control. The better controller performance lead to the smaller outage probability and substantial capacity improvements.

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