Chapter 4

A GENERIC FUZZY LOGIC BASED HANDOFF ALGORITHM

This chapter proposes a new class of handoff algorithms that combines the attractive features of several existing algorithms and adapts the handoff parameters using fuzzy logic. Known sensitivities of handoff parameters are used to create a fuzzy logic rule base. The design procedure for a generic fuzzy logic based algorithm is outlined. Extensive simulation results for a conventional handoff algorithm (absolute and relative signal strength based algorithm) and a fuzzy logic based algorithm are presented. This chapter shows that an adaptive multicriteria fuzzy handoff algorithm performs better than a signal strength based conventional handoff algorithm. More importantly, the proposed class of algorithms allows a systematic tradeoff among different system characteristics in the dynamic cellular environment.

4.1 HANDOFF ALGORITHMS: DESIGN AND ANALYSIS ISSUES

This section discusses design and analysis procedures for a handoff algorithm. Several steps involved in the handoff algorithm design are outlined.

Figure 4.1 shows a block diagram that illustrates the design of high performance handoff. Steps involved in the handoff algorithm design and analysis are listed below.

1. **Analysis of Handoff Related System Goals.** Study handoff related cellular system goals. Analyze desirable features of a handoff algorithm, and determine the required attributes of a handoff algorithm.

2. **Determination and Preprocessing of Handoff Criteria.** Determine handoff criteria based on desired goals, system requirements, and availability of measurements. Preprocess handoff criteria before using them in a handoff algorithm. For example, some criteria, such as RSS, may need averaging.
3. **Handoff Strategy.** Process the handoff criteria using a selected strategy. Adapt the parameters of the handoff strategy by considering the performance metrics and the desired goals.

4. **Handoff Evaluation.** Evaluate the developed algorithm using a suitable simulation model.

![Block Diagram of a High Performance Handoff Algorithm](image)

*Figure 4.1: Block Diagram of a High Performance Handoff Algorithm.*

This research uses the simulation approach for evaluating the performance of handoff algorithms. Details of the macrocellular simulation model used for performance evaluation of handoff algorithms are given in Section 3.2.4 of Chapter 3.

### 4.2 A CLASS OF FUZZY LOGIC BASED ADAPTIVE HANDOFF ALGORITHMS

#### 4.2.1 Design Procedure

This chapter proposes a new class of adaptive handoff algorithms based on fuzzy logic, and Figure 4.2 shows a generic block diagram of this proposed class. The main idea is to combine attractive features of existing algorithms to obtain an efficient algorithm and to adapt the parameters of this efficient algorithm to the dynamic cellular environment using a fuzzy logic system.