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BORANG PENGESAHAN STATUS TESIS

Judul: **THE HANDOFF PROCESS FOR 3RD GENERATION MOBILE SYSTEM**

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Dedicated to my beloved and loved ones

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ABSTRAK

Generasi ketiga dalam system komunikasi 'mobile' akan merangkumi aplikasi multimedia beserta dengan suara dan data. Pada asasnya, projek ini akan mengkaji tentang keberkesanan proses 'handoff' untuk system 3G. Dalam kajian ini, jaringan generasi ketiga akan dirujuk sebagai UMTS (Universal Mobile Telecommunications System). Sistem CDMA (Code Division Multiple Access) memainkan peranan yang penting dalam generasi 'mobile' yang ketiga. Ini adalah untuk memastikan servis yang lebih berkualiti dan menyediakan jaringan 'soft handoff' yang lebih fleksibal yang telah diaplikasikan dalam system CDMA. Kajian ini memberi diskripsi tentang 'soft handoff' dalam system UMTS dan mengkaji tentang kesan 'handoff' CDMA dalam sistem 3G. Kajian ini juga melibatkan penggunaan perisian MathCAD dan MATLAB untuk pengiraan serta memplotkan graf.

ABSTRACT

The third generation of mobile communication systems will include the multimedia application together with voice and data. Basically, this project will investigate about the efficient handoff control process for the 3G mobile system. In this research this third generation networks are referred to as UMTS (Universal Mobile Telecommunications System). CDMA (Code Division Multiple Access) is the main third generation air interface. In order to ensure a high quality of service and provide flexibility in the network soft handoff has been implemented in the CDMA air interface. This research gives a description of soft handoff in the UMTS system and analyses the impact of this CDMA handoff type on the 3G system. This research also involves the use of software such as MathCAD and MATLAB for calculation and plotting the result that had been obtained.

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INTRODUCTION

1.0 Introduction to Fundamental of Cellular Mobile System

Fundamental of Cellular System will highlights early cellular system, mobile cellular components, such as the mobile station and base station. Further more, it will cover on cell design issue, such as cell shape and size. The concepts of cell splitting, cell reuse, and cell sectoring are introduced. Finally, fundamental of Cellular System also concern about the handoff process from one cell to another cell during calls.

1.1 Earlier System

Earlier system using radio system, where a user assigned to a fixed transmits and received frequency. Therefore, each radio channel was dedicated to a specific user or perhaps of a group of users. Transition to a newer system has introduced to trunk radio systems where channels are made available to all users. Hence, no channel is fixed or dedicated to any one user. The advantage of this approach is the increased of spectrum usage, but it does translate into more complex equipment by requiring the system to be frequency agile [1].

1.2 Typical Cell Layout

The Mobile Telephone Switching Office (MTSO), the cell and its Base Transceiver Station (BTS), and the Mobile Unit or Mobile Station (MS) are the principal component of this system.

1.2.1 Mobile Telephone Switching Office (MTSO)

MTSO is responsible for switching the calls to the cell, providing backup, interfacing with telephone network, monitoring traffic for charging activities, performing testing and diagnostic services, and managing overall network. It is the control element for this system.

1.2.2 Mobile Station (MS)

The MS is referring to mobile transceiver. It contain a frequency-agile machine that allow it to change to a particular frequency designated for its use by MTSO [1].

1.2.3 Base Transceiver Station (BTS)

The air interface between MS and MTSO. BTS sends and receives traffic to/from the MS by receiving signals and directions from the MTSO.

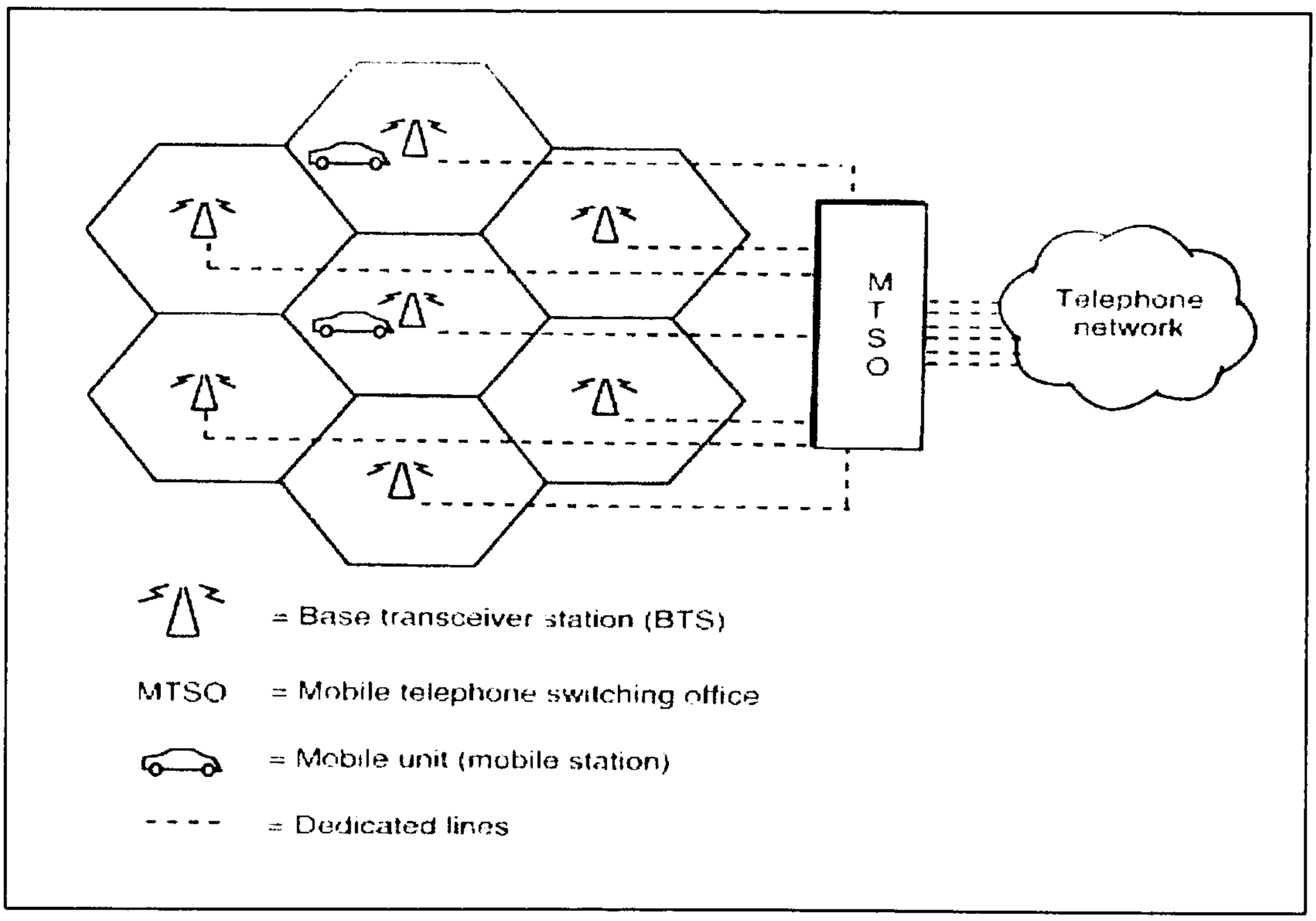

Figure 1.1 Cellular radio topology [1]

1.3 Size and Shape of Cell

To achieve full coverage without dead spots, a series of regular polygons for cell sites are required. Any regular polygon, such as equilateral triangle, a square, or a hexagon can be used for cell design. The hexagon is used for two reasons: first, a hexagonal layout requires fewer cells and therefore fewer transmitter sites and second, a hexagonal cell layout is less expansive compared to square and triangular cells [1]. The hexagonal is not practical because its boundaries but it is the most ideal shape close to circle, which is an ideal shape for signal coverage. Moreover, hexagonal shape can be easily arranged side-by-side to avoid overlapping cells. The hexagonal shape also useful because directional antennas can be installed at the BS and transmit within sector of a cell.

1.3.1 Frequency Reuse

It depends on several factors; (1) the power of transmitted signal, (2) the frequency used, (3) the type of antenna, (4) the height of antenna, (5) weather, (6) the terrain over which the signal is sent. The increase of the distance between cells using same frequency (D), will reduces the chances of co-channel interference from cells using the same frequency. But it also means that the number of channels assigned to each cell becomes smaller, which results the management of the spectrum and the trunks also not efficient. Figure 1.2 shows the distance of reuse frequency in cells.

1.3.2 Spectrum Efficiency

From the explanation from 1.4.1, it shows that small cells assigned to more channel capacity. The trade off is the increased overhead of handing off calls across cells, and the overhead of keeping the user location accurate.

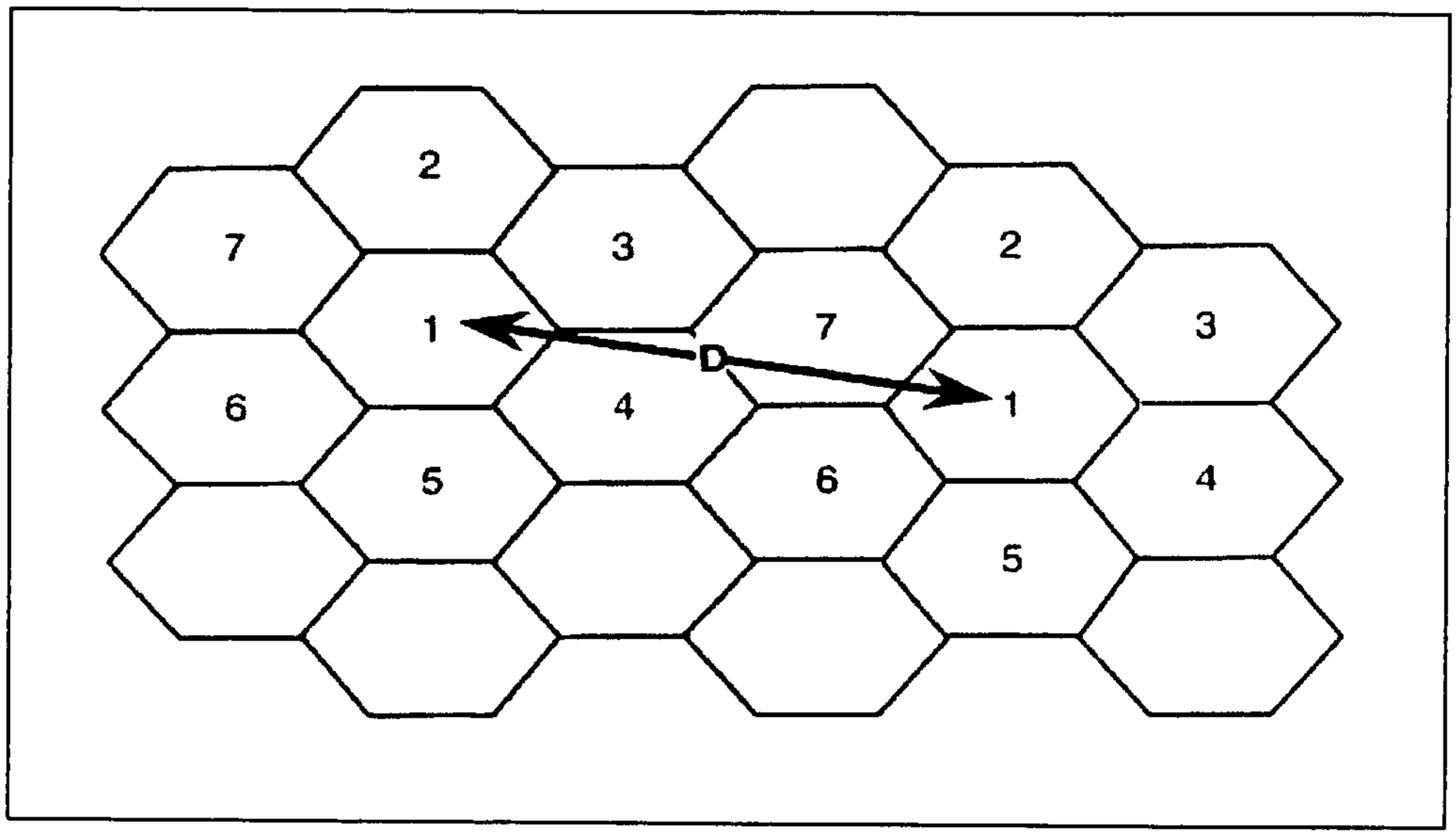

Figure 1.2 The reuse distance D [1]

1.4 Cell Splitting

When the traffic in particular cell increases, the cell will split into small cells. The process of cell splitting can be done by cell areas, or the individual component coverage areas of the cellular system, are divided to produce more areas. The addition of new cells will increase the amount of channel reuse and of course, increasing subscriber serving capacity. This also implies that the decreasing of radius of cell will results more handoffs per call and a higher processing load per subscriber. Figure 1.3 shows the process of cell splitting.

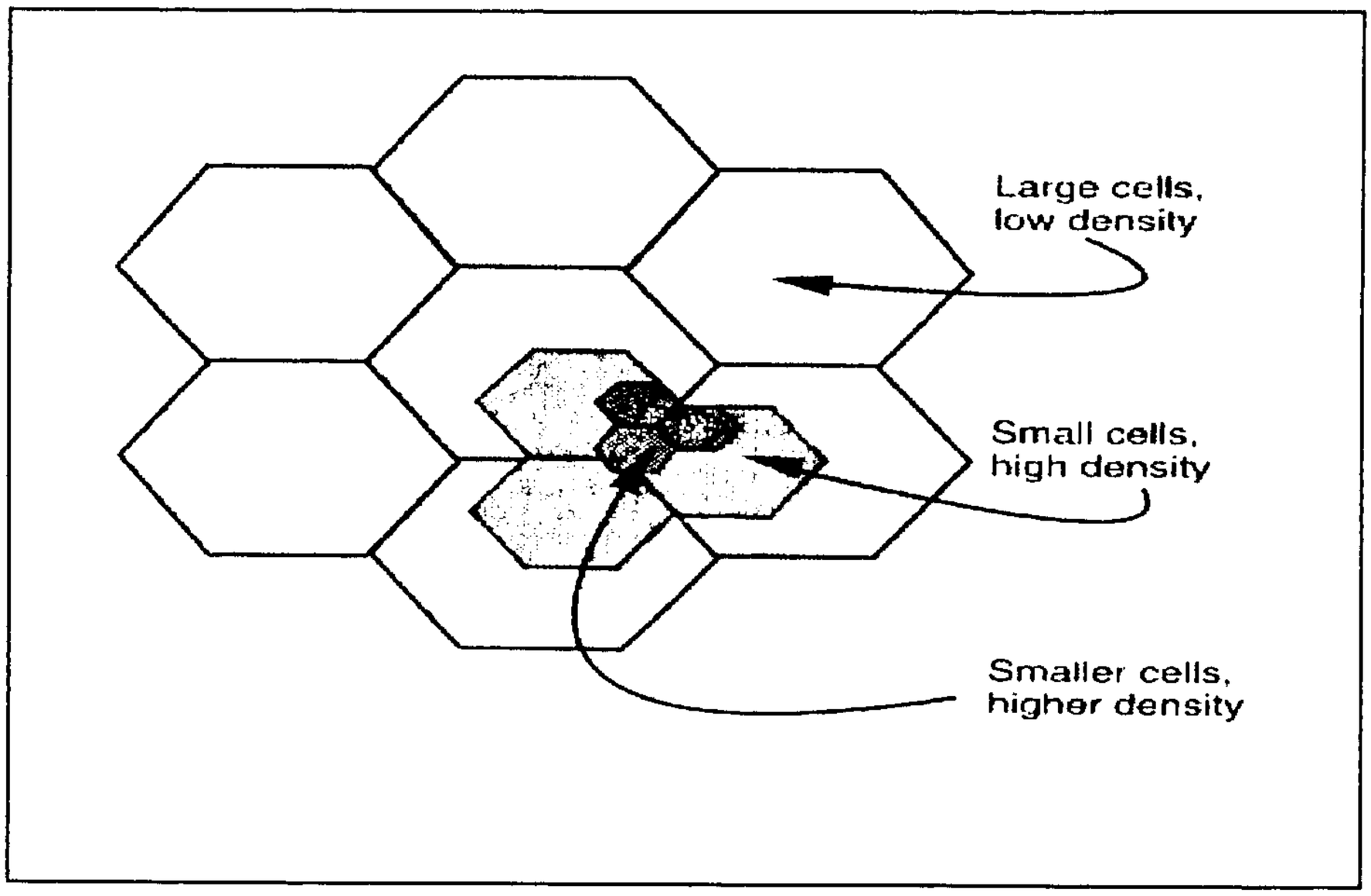

Figure 1.3 Cell splitting [1]

1.5 Cell Sectoring

Another technique for making more efficient use of limited frequency is call cell sectoring. This method of operation will allow a cell that needs more capacity to borrow channels from its neighbor. The borrowing cell is called the hot spot, and the donating cell is called the donor. The advantage of sectorization is it can reduces the co-channel interference and improves co-channel interference (S/I) ratio for a given cell reuse factor. The disadvantage is it reduces trunking efficiency since the channel resource is distribute thinly among the various sectors. Thus, spectrum efficiency of a sectorized system is reduced if the cluster (a group of cell) is kept constant. To overcome this problem, since a sectorized cellular system has fewer co-channel interferers, it is possible to reduce the cluster size, hence increasing the spectrum efficiency of the overall system. Figure 1.4 (a) and 1.4 (b) both shows the process of channel borrowing and sectoring the cells.

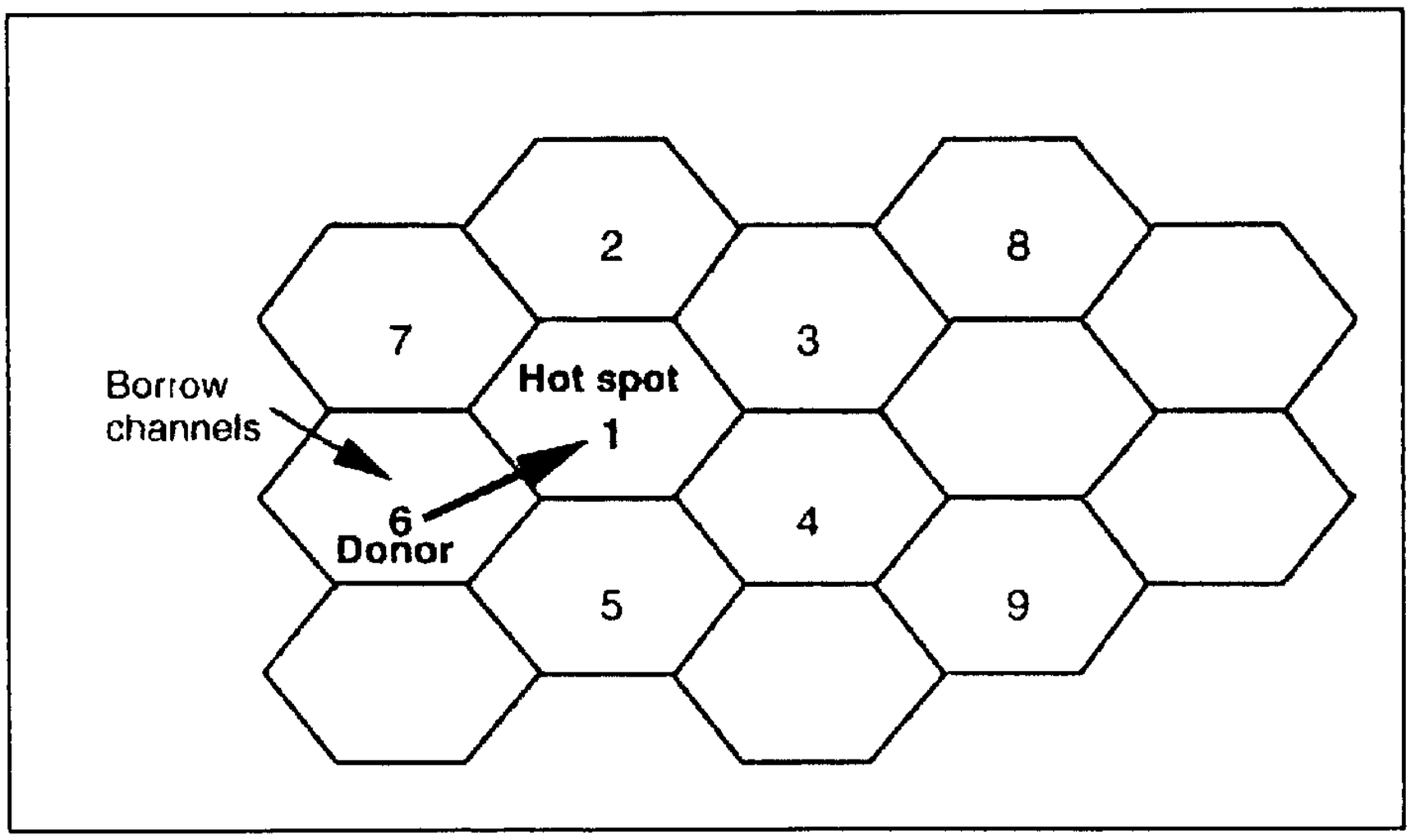

Figure 1.4 (a) Channel Borrowing [1]

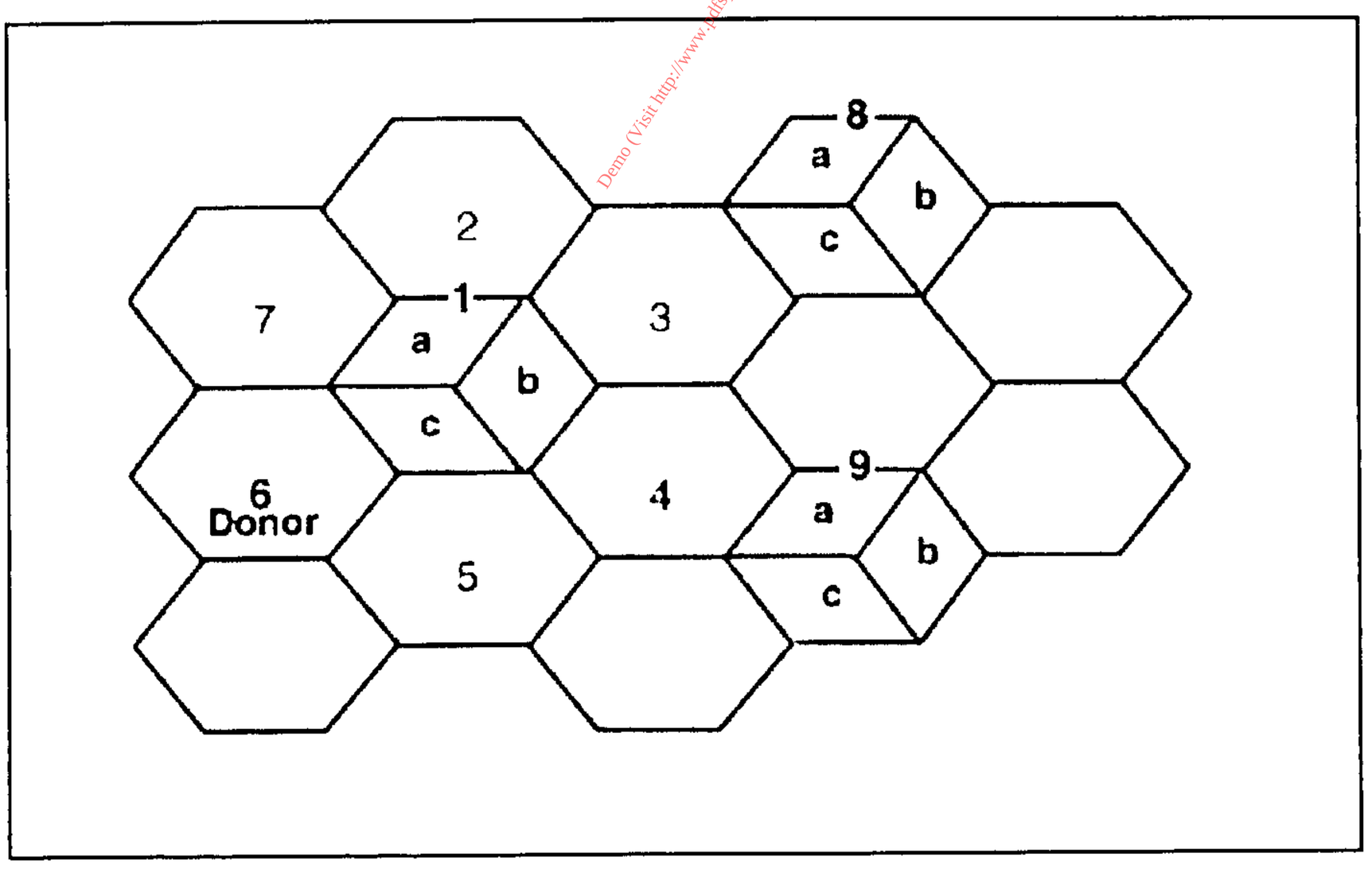

Figure 1.4 (b) Sectoring the Cells [1]

1.6 Handoff

Handoff is the process used to allow a call in progress to continue as the mobile terminal moves between cells. As the mobile station (MS) moves through aboundary region, it will likely move into another cell. Therefore, a handoff takes place that allow the unit to be assigned a free channel in the new cell. As the signal strength between the unit and the base station (BS) controller become weaker, the MTSO informed. MTSO will generate a procedure to pass the connection to a cell which has a strong reception pf the mobile station's frequency. The old channel in the old cell is freed and made available for another user in that cell once the unit has been given to a new channel in the new cell. Figure 1.5 (a) and 1.5 (b) shows the process of handing off the call.

Handoff can be classified as soft or hard handoff, based on the following definitions.

1.6.1 Soft Handoff

It occurs mobile communication is passed to the target radio port without interrupting communication with the current serving radio port. In a soft handoff, the mobile terminal communicates with two radio port simultaneously, with the signals from the radio ports to the terminal treated as multipath signals that coherently combined at the mobile.

1.6.2 Hard Handoff

It occurs when the communication to the mobile terminal is passed between disjointed radio systems, different frequency assignments, or different air interface characteristic or technologies. A hard handoff is a "break-before-make" process at the air interface.

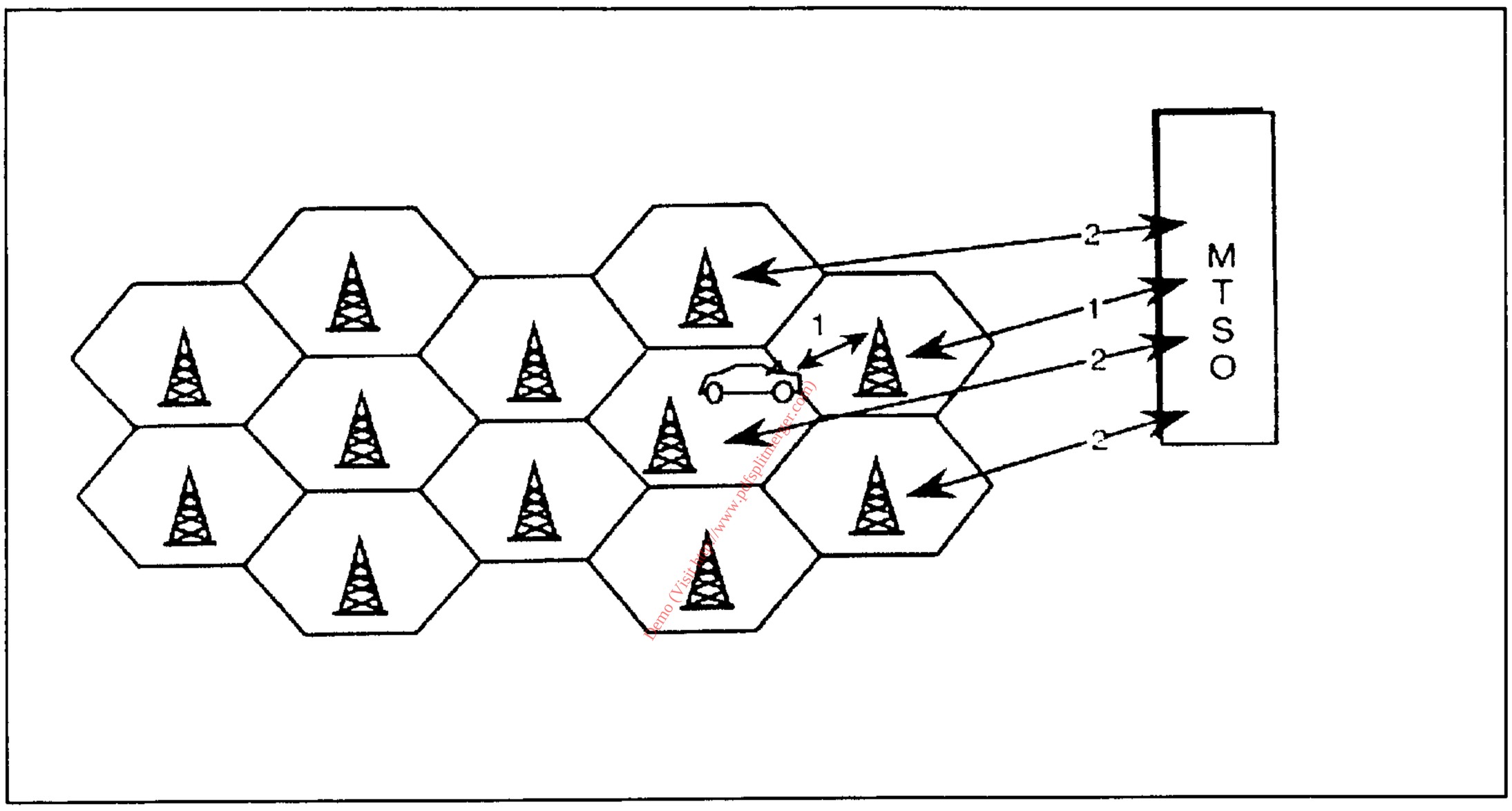

Figure 1.5 (a) : MTSO notes reduce signal strength. Other cells request to take over connection. [1]

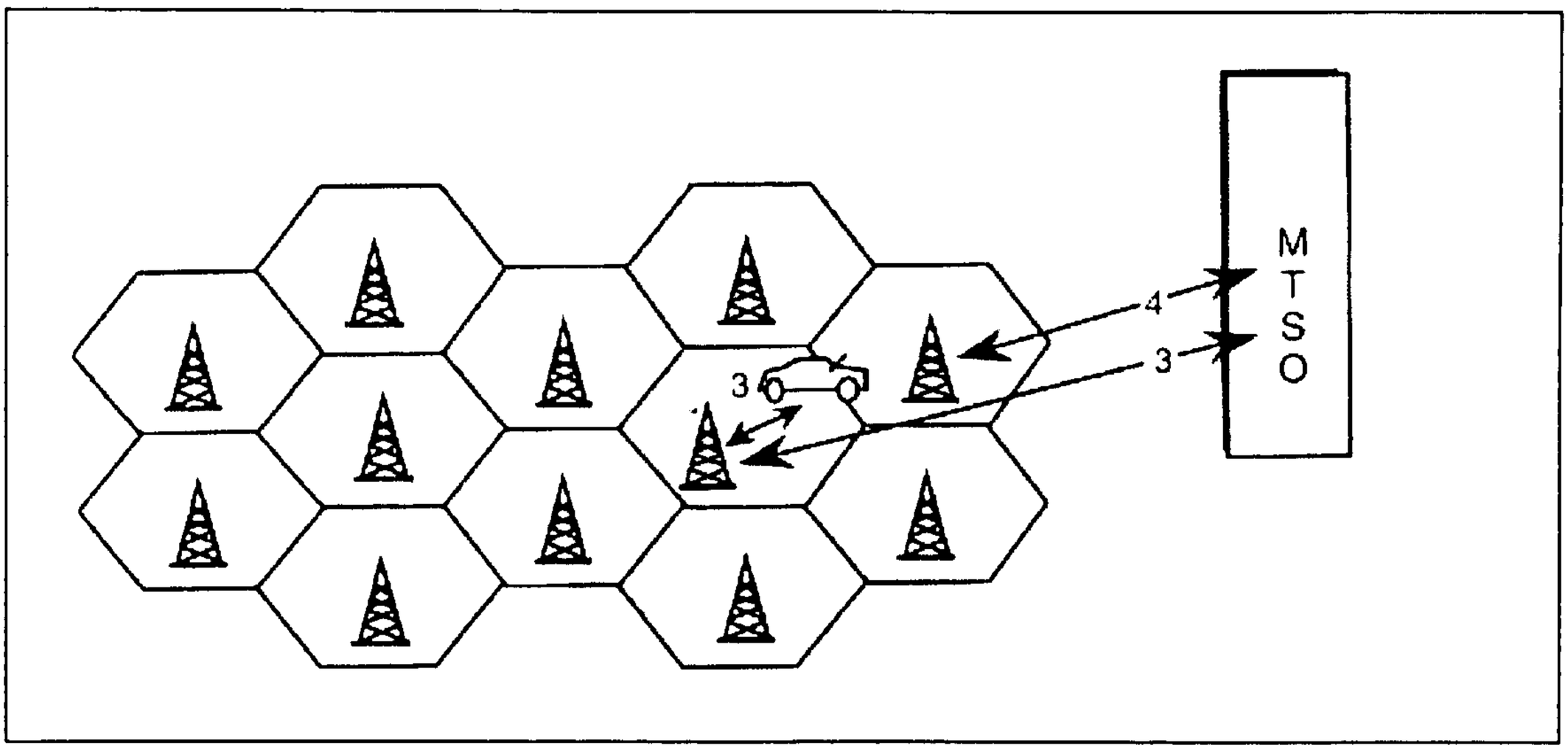

Figure 1.5 (b): Communication established and channel set up with new cell. Channel in old cell is released for reuse. [1]

The main part of this project will focus on the handoff process in the third generation (3G) mobile system. This handoff process will be further discuss on the next chapter 2.

1.7 Objectives of Project

The main objectives of this project are to;

1. Analyse and investigate types of handoff process criteria that used in 3rd Generation Mobile System.
2. Find out the most suitable method of handoff process for the 3G mobile system.
3. To calculate all the data using MathCad (software).
4. To implement the result using MATLAB (software).
5. To plot the result using MATLAB (software).