ISSN 0926-6801

Journal of High Speed Networks

Volume 13 Number 1 2004

IOS Press

Editor-in-chief: Prof. D. Sidhu

Journal of High Speed Networks 13 (2004) 25–36
IOS Press

A new fractional channel policy

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Abstract. Dropping probability of handoff calls and blocking probability of new calls are two important QoS measures for cellular networks. Since the dropping probability of handoff calls is more important, call admission policies are used to maintain the upper bound of dropping probability of handoff calls. The fractional channel policy (FC) is a general call admission policy and includes most prioritized channel allocation schemes such as guard channel (GC) and limited fractional channel (LFC) policies. In this paper, we introduce a subclass of fractional channel policy, called uniform fractional channel policy (UFC) and study its performance. Expressions for both dropping probability of handoff calls and blocking probability of new calls are derived. Then it is shown that there is an optimal value for the parameter of UFC, which minimizes the blocking probability of new calls with the constraint on the upper bound on the dropping probability of handoff calls. An algorithm for finding the optimal parameter of UFC is also given. Conditions under which the UFC performs better than GC is derived. It is concluded that, the UFC policy performs better than GC policy under the low handoff/new traffic ratio.

Keywords: Cellular mobile networks, guard channel policy, uniform fractional channel policy.

1. Introduction

Recently, the demand for cellular networks has massively grown. As a result, the demand for channels is on rise. Since number of channels is limited, efficient use of channels is important. In order to use channels efficiently, micro-cellular networks are introduced in which the service area is partitioned into regions called cells. Each cell has a base station, which manages allocation of channels to mobile hosts. As a mobile host moves from one cell to another, any active call needs to be allocated a channel in the destination cell. This event is called handoff and must be transparent to the mobile host. If the destination cell has no available channels, then the call is dropped. The disconnection in the middle of a call is highly undesirable and one of the goals of the network designer is to keep such disconnections low.

Introduction of micro cellular networks leads to efficient use of channels but increases expected rate of handovers per call. As a consequence, some network performance parameters such as *blocking probability of new calls* (B_n) and *dropping probability of handoff calls* (B_h) are affected. These two parameters are dependent to each other. For example, accepting more handoff calls increases the blocking probability of new calls and visa versa. As a result, there is a trade-off between these two performance parameters. In order to have these performance parameters at reasonable level, *call admission policies* are used. The call admission policy plays a very important role in the cellular networks because it directly controls B_n and B_h. Call admission policies control B_n and B_h by putting some restrictions on allocation of channels to calls. Since the dropping probability of handoff calls is more important than the blocking probability of new calls, call admission policies usually give a higher priority to handoff calls. This priority is implemented through allocation of more channels for handoff calls [7].

Fractional channel policy (FC), which is a general call admission policy, accepts new calls with a certain probability that depends on the current channel occupancy and accepts handoff calls as long as channels are available [9]. Suppose that the given cell has C full duplex channels. The FC policy uses a vector $\Pi = \{\pi_0, \dots, \pi_{C-1}\}$ to accept the new calls, where $0 \leqslant \pi_i \leqslant 1$, $0 \leqslant i < C$. This policy accepts new calls with probability π_k when k

($0 \leqslant k < C$) channels are busy. Depending on the vector Π, we may have different call admission policies and some of which are reviewed below.

A restricted version of FC is called *guard channel policy* (GC) [5,6,8]. The guard channel policy reserves a subset of channels allocated to a cell, called *guard channels*, for handoff calls (say $C - T$ channels). Whenever the channel occupancy exceeds a certain threshold T, the guard channel policy rejects new calls until the channel occupancy goes below the threshold. The guard channel policy accepts handoff calls as long as channels are available. Note that the GC policy can be obtained from FC policy by setting $\pi_k = 1$ for $0 \leqslant k < T$, and $\pi_k = 0$ for $T \leqslant k < C$. It has been shown that there is an optimal threshold T^* at which the blocking probability of new calls is minimized subject to the hard constraint on the dropping probability of handoff calls and an algorithm for finding such optimal threshold is given in [5]. The GC policy reserves an integral number of guard channels for handoff calls. If performance parameter B_h is considered, the guard channel policy gives very good performance, but performance parameter B_n is degraded to great extent. In order to have more control on blocking probability of new calls and dropping probability of handoff calls, *limited fractional channel policy* (LFC) is introduced [9]. The LFC can be obtained from FC policy by setting $\pi_k = 1$ for $0 \leqslant k < T$, $\pi_T = \pi$ and $\pi_k = 0$, for $T < k < C$. It has been shown that there is an optimal threshold T^* and an optimal value of π^* for which blocking probability of new calls is minimized subject to the hard constraint on dropping probability of handoff calls. An algorithm for finding these optimal parameters is given in [9]. The extensions of the above for cellular networks supporting multi-media services are given in [1–3,10]

There are call admission policies which allow either handoff or new calls to be queued until free channels are obtained in the cell [4,11].

In this paper, we introduce a new version of FC policy, called *uniform fractional channel policy* (UFC). The UFC policy accepts new calls with probability of π independent of channel occupancy. The UFC can be obtained from FC by setting $\pi_k = \pi$ for $0 \leqslant k < C$. It is shown that there is an optimal value for the parameter of UFC which minimizes blocking probability of new calls with the constraint on the upper bound on dropping probability of handoff calls and an algorithm for finding such optimal parameter is also given. Then conditions under which the UFC performs better than the GC is derived. It is concluded that, the UFC policy performs better than GC policy under the low handoff traffic conditions. The simulation results also confirm our analytical results.

The rest of this paper is organized as follows: Section 4 presents the UFC policy, its performance parameters and an algorithm for find the optimal value of its parameter. The computer simulations is given in Section 6 and Section 7 concludes the paper.

2. Guard channel policy

In this section, we review guard channel policy. We assume that the given cell has a limited number of full duplex channels, C, in its channel pool. We define the state of a particular cell at time t to be the number of busy channels in that cell and is represented by $c(t)$. The guard channel policy reserves a subset of channels allocated to a particular cell for handoff calls (say $C - T$ channels). Whenever the channel occupancy exceeds the certain threshold T, the guard channel policy rejects new calls until the channel occupancy goes below the threshold. The guard channel policy accepts handoff calls as long as channels are available. The description of fractional channel policy is given algorithmically in Fig. 1.

3. Blocking performance of guard channel policy

In this section, we study the blocking performance of the GC policy. We consider a homogenous wireless network where all cells have the same number channels C and experience the same new and handoff call arrival rates. In each cell, the arrival of new calls and handoff calls are Poisson distributed with arrival rates λ_n and λ_h, respectively. Let $\lambda = \lambda_n + \lambda_h$ and $\alpha = \lambda_h/\lambda$. In each cell, the channel holding time of new and handoff calls

```
if (HANDOFF CALL) then
    if (c(t) < C ) then
        accept call
    else
        reject call
    end if
end if
```

```
if (NEW CALL) then
    if (c(t) < T) then
        accept call
    else
        reject call
    end if
end if
```

Fig. 1. Guard channel policy.

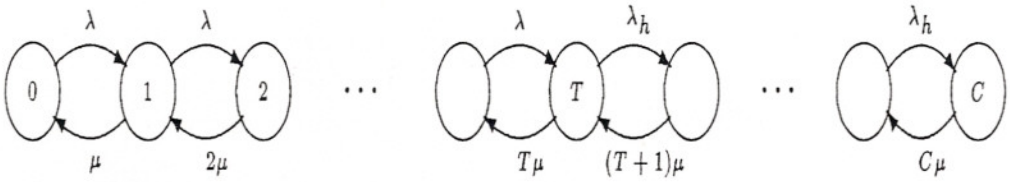

Fig. 2. Markov chain model of cell.

are exponentially distributed with mean μ^{-1}. Let $\rho = \lambda/\mu$. Note that the same service rate for both types of calls implies that the base station of a cell does not need to discriminate between new and handoff calls, once they are connected. This set of assumptions have been found reasonable as long as the number of mobile computers in a cell is much greater than the number of channels allocated to that cell. We define the state of a particular cell at time t to be the number of busy channels in that cell and is represented by $c(t)$. $\{c(t)|t \geqslant 0\}$ is a continuous-time Markov chain (birth-death process) with states $0, 1, \ldots, C$. The state transition rate diagram of a cell with C full duplex channels and GC call admission policy is shown in Fig. 2.

Define the steady state probability

$$P_n = \lim_{t\to\infty} \mathrm{Prob}[c(t) = n], \quad n = 0, 1, \ldots, C. \tag{1}$$

The steady state probability P_n that n channels are busy is given by the following expression [6].

$$P_n = \begin{cases} \dfrac{\rho^n}{n!} P_0 & 0 \leqslant n \leqslant T \\ \dfrac{\rho^n \alpha^{n-T}}{n!} P_0 & T < n \leqslant C, \end{cases} \tag{2}$$

where P_0 is the probability that all channels are free and is calculated by the following expression.

$$P_0 = \left[\sum_{k=0}^{T} \frac{\rho^k}{k!} + \sum_{k=T+1}^{C} \frac{\rho^k \alpha^{k-T}}{k!} \right]^{-1}. \tag{3}$$

Using above expressions, we can drive an expression for dropping probability of handoff calls using C channels and $C - T$ guard channels.

$$\begin{aligned} B_h(C, T) &= P_C, \\ &= \frac{\rho^C \alpha^{C-T}}{C!}. \end{aligned} \tag{4}$$

Similarly, the blocking probability of new calls is given by the following expression.

$$B_n(C,T) = \sum_{k=T+1}^{C} P_k, \\ = \sum_{k=T+1}^{C} \frac{\rho^k \alpha^{k-T}}{k!}. \quad (5)$$

4. Uniform fractional channel policy

In this section, we first review FC policy and then introduce a restricted version of FC, called *uniform fractional channel policy* (UFC).

Fractional Channel Policy. The FC policy is a general call admission policy, which other call admission policies are restricted versions of it. The description of fractional channel policy is given algorithmically in Fig. 3. This policy, which uses vector $\Pi = \{\pi_0, \ldots, \pi_{C-1}\}$ and accepts new calls with probability π_k when k channels in the cell are busy. The FC policy accepts handoff callsa as long as the cell has free channels. No algorithm is reported for finding the optimal vector Π^*. Function *rand(a, b)* in Fig. 3 generates a random number in interval $[a, b]$.

Uniform Fractional Channel Policy. The UFC policy uses admission probability π, which is independent of channel occupancy, to accept new calls and accepts handoff calls as long as free channels are available. This policy can be obtained from FC policy by setting $\pi_k = \pi$ for $k = 0, 1, \ldots, C-1$. The UFC policy reserves non-integral number of guard channels for handoff calls by rejecting new calls with probability $(1-\pi)$. The description of uniform fractional channel policy is given algorithmically in Fig. 4.

if (HANDOFF CALL) **then**
  if ($c(t) < C$) **then**
    accept call
  else
    reject call
  end if
end if

if (NEW CALL) **then**
  if ($c(t) < C$ **and** rand (0,1) $< \pi_{c(t)}$) **then**
    accept call
  else
    reject call
  end if
end if

Fig. 3. Fractional channel policy.

if (HANDOFF CALL) **then**
  if ($c(t) < C$) **then**
    accept call
  else
    reject call
  end if
end if

if (NEW CALL) **then**
  if ($c(t) < C$ **and** rand (0,1) $< \pi$) **then**
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  else
    reject call
  end if
end if

Fig. 4. Uniform fractional channel policy.

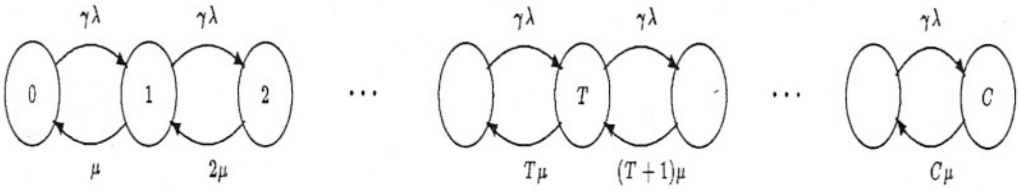


Fig. 5. Markov chain model of cell.

5. Blocking performance of uniform fractional channel policy

In this section, we study the blocking performance of the UFC policy. The blocking performance of the UFC policy is computed based on the assumptions given in Section 3. The state transition rate diagram of a cell with C full duplex channels and UFC call admission policy is shown in Fig. 5.

At state $0 \leqslant n < C$, new calls are accepted with probability $0 \leqslant \pi \leqslant 1$ and handoff calls are accepted with probability 1. Both types of calls are blocked in state C. Thus, the state dependent arrival rate in the birth-death process of Fig. 5 is equal to $[a + (1 - a)\pi]\lambda$. We can easily write down the steady-state balance equations for this Markov chain. By writing down the equilibrium equations for the steady-state probabilities P_n $(n = 0, 1, \ldots, C)$, we obtain

$$\gamma\lambda P_{n-1} = n\mu P_n,$$

where $\gamma = [a + (1 - a)\pi]$. Then, the following expression can be derived for P_n $(n = 0, 1, \ldots, C)$.

$$P_n = \frac{(\rho\gamma)^n}{n!} P_0, \tag{6}$$

where P_0 is the probability that all channels are free and obtained using equation $\sum_{n=0}^{C} P_n = 1$. The value of P_0 is calculated by the following expression.

$$P_0 = \left[\sum_{n=0}^{C} \frac{(\rho\gamma)^n}{n!}\right]^{-1}. \tag{7}$$

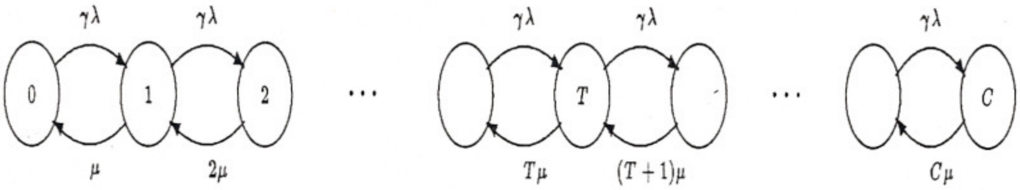
Given the state probabilities, we can find the dropping probability of handoff calls, $B_h(C, \pi)$, by the following expression.

$$\begin{aligned} B_h(C, \pi) &= P_C, \\ &= \frac{(\rho\gamma)^C}{C!} P_0. \end{aligned} \tag{8}$$

Similarly, the blocking probability of new calls, $B_n(C, \pi)$ is given by the following expression.

$$\begin{aligned} B_n(C, \pi) &= \sum_{n=0}^{C-1} (1 - \pi) P_n + P_C, \\ &= 1 - \pi\big[1 - B_h(C, \pi)\big]. \end{aligned} \tag{9}$$

Below we study some of the useful properties of $B_n(C, \pi)$ and $B_h(C, \pi)$. These properties will be used later in this paper.



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Below we study some of the useful properties of $B_n(C, \pi)$ and $B_h(C, \pi)$. These properties will be used later in this paper.

Property 5.1. *For any given value of* $0 \leqslant \pi \leqslant 1$ *and* C, *the following inequality holds.*

$$B_h(C, \pi) \leqslant B_n(C, \pi).$$

Proof. The proof is trivial from equations (8) and (9). □

Property 5.2. *For any given constraint* $\rho/C < 1$, $B_h(C, \pi)$ *is a monotonically increasing function of* π.

Proof. By differentiating $B_h(C, \pi)$ with respect to π, we obtain

$$\begin{aligned} \frac{\partial B_h(C, \pi)}{\partial \pi} &= (1-a)P_C\left[\frac{C}{\gamma} - \rho(1-P_C)\right], \\ &> (1-a)P_C[C-\rho]. \end{aligned}$$

Since the values of $(1-a)$ and P_C are non-negative, $\partial B_h(C, \pi)/\partial \pi$ is greater than zero if inequality $C - \rho > 0$ (or $\rho/C < 1$) holds. □

Property 5.3. *For any given constraint* $C < \lambda_h/\lambda p_h$, $B_n(C, \pi)$ *is a monotonically decreasing function of* π.

Proof. By differentiating $B_n(C, \pi)$ with respect to π, we obtain

$$\begin{aligned} \frac{\partial B_n(C, \pi)}{\partial \pi} &= P_C\left[1 + \pi\frac{C(1-a)}{\gamma} - \pi\rho(1-a)(1-P_C)\right] - 1, \\ &< P_C\left[1 + \frac{C}{\gamma} - \rho(1-P_C)\right] - 1, \\ &< P_C\left(1 + \frac{C}{\gamma}\right) - 1. \end{aligned}$$

$\partial B_n(C, \pi)/\partial \pi$ is negative if $P_C(1 + (C/\gamma)) - 1$ is negative. Thus, we have $C/\gamma < (1/P_C) - 1$. Since P_C is at most equal to p_h, thus we have $C/\gamma < (1/p_h) - 1 < (1/P_C) - 1$. By some algebraic simplification, we have $C < \lambda_h/\lambda p_h$. □

In the next two subsections, we first give a binary search algorithm to find the optimal value of parameter π and then compare the performance of UFC and GC policies.

5.1. Finding optimal parameter of UFC policy

In this section, we consider the problem of finding the optimal value of admission probability (π^*) when the number of channels allocated to a particular cell is held fixed. Given C channels allocated to a cell, the objective is to find π^* that minimizes $B_n(C, \pi)$ subject to the hard constraint $B_h(C, \pi) \leqslant p_h$. Thus, we have the following nonlinear optimization problem for the proposed call admission policy.

Problem 5.1. Minimize $B_n(C, \pi)$ subject to the hard constraint

$$B_h(C, \pi) \leqslant p_h,$$

where p_h is the level of QoS to be satisfied for handoff calls.

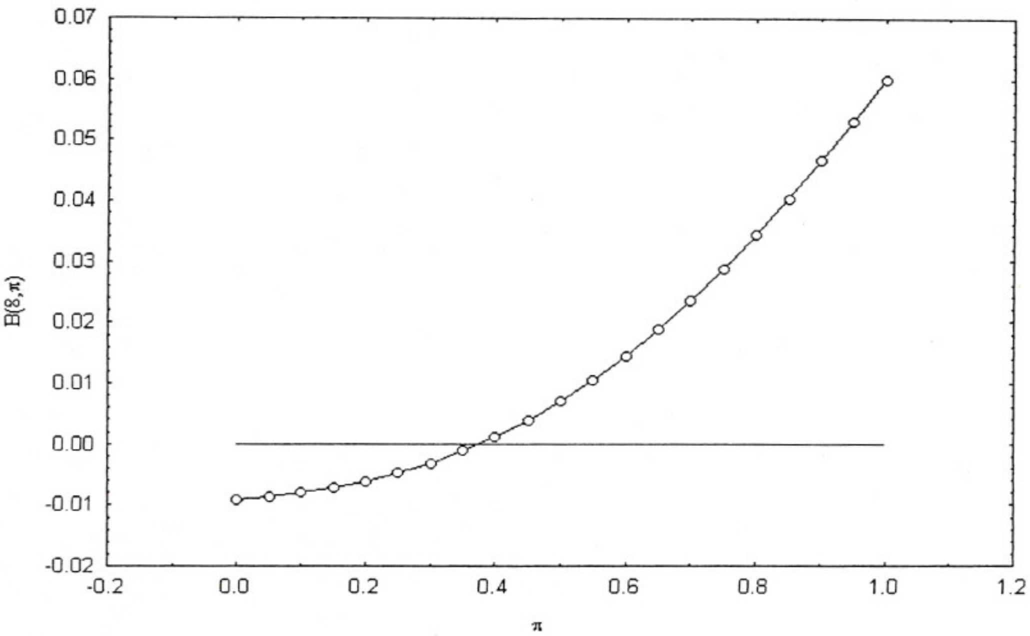

Fig. 6. The existence and uniqueness of the solution of the problem 5.1.

The value of p_h is specified by the quality requirement of service of the network. Since, cellular networks usually provide the same level of quality of service as the public switched telephone networks (PSTN), p_h is set equal to the quality of service of PSTN, which may range from one percent to five percent and two percent being the most common used values. In order to find the solution of the above problem, we first study the existence and uniqueness of the solution by the following theorem.

Theorem 5.1. *Let $B_h(C,0) \leqslant p_h$ and $B_h(C,1) \geqslant p_h$, then there exists a unique π^* that minimizes $B_n(C,\pi)$ while the constraint $B_h(C,\pi) \leqslant p_h$ is satisfied.*

Proof. Define

$$B(\pi) = B_h(C,\pi) - p_h,$$

and consider $B(\pi)$ at its two end points. Thus we have

$$B(\pi) = \begin{cases} B_h(C,0) - p_h \leqslant 0 & \pi = 0 \\ B_h(C,1) - p_h \geqslant 0 & \pi = 1. \end{cases} \tag{10}$$

Since $B(.)$ is continuous function of π, then there exists at least a π^* such that $B(\pi^*) = 0$ (Fig. 6). Uniqueness follows since $B(.)$ is a strictly increasing function of π (Lemma 5.2). Since $B_n(C,\pi)$ is a strictly decreasing function of π (Lemma 5.3), value π^* minimizes B_n subject to the hard constraint on $B_h(C,\pi) \leqslant p_h$. □

Condition $B_h(C,0) \leqslant p_h$ in the above theorem implies that when all channels allocated to the cell are used for handoff calls, the level of QoS is satisfied and condition $B_h(C,1) \geqslant p_h$ implies that a higher priority will be given to the handoff calls. A graph of the functions $B_h(C,\pi)$ and $B_n(C,\pi)$ versus π is shown in Fig. 7. The traffic parameters correspond to those of case 5 in Table 1, which satisfies Properties 5.2 and 5.3.

In what follows, we give an algorithm for solving Problem 5.1. This algorithm is given in Fig. 8 and can be described as follows. At first, the algorithm considers the case when all channels are shared between handoff and new calls. If the complete sharing doesn't satisfy the level of QoS, then the algorithm considers the case when all

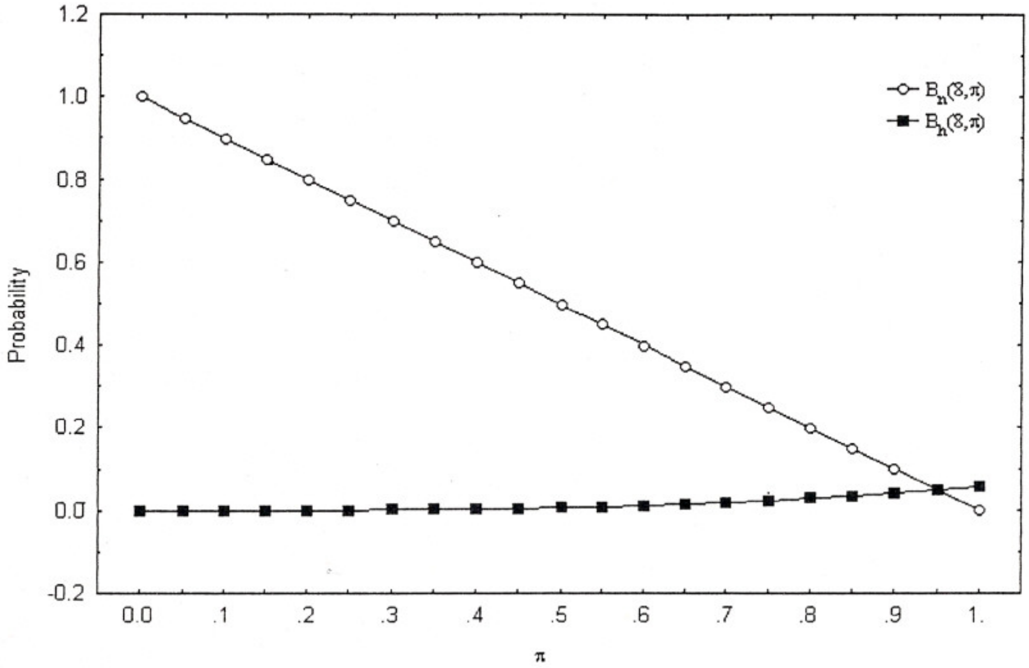

Fig. 7. The effect of π on the blocking probabilities ($\lambda_h = 10$).

```
set upper ← 1; lower ← 0
if (B_h(C, 1) ⩽ p_h) then
    return 1
end if
if (B_h(C, 0) ⩾ p_h) then
    return 0
end if
set k ← 0
while (k < 20 and (upper - lower) < 0.0001) do
    set π ← (upper + lower) / 2
    if B_h(C, π) > p_h ) then
        set upper ← π
    else
        set lower ← π
    end if
    set k ← k + 1
end while
return π
```

Fig. 8. Algorithm for determination of π^*.

channels are exclusively used for handoff calls. If the exclusive use of channels for handoff calls doesn't satisfy the level of QoS, then the number of allocated channels to the cell is not sufficient and the algorithm terminates; otherwise the algorithm searches for the optimal value of π^*. The search method used in this algorithm is binary search.

The following theorem is concerned with the optimality of the solution found by the algorithm given in Fig. 8.

Table 1

Comparison of simulation results for different policies

		GC		UFC	
Item	λ_h	B_n	B_h	B_n	B_h
1	2	0.063507	0.001525	0.023935	0.024675
2	4	0.077080	0.003538	0.089897	0.023639
3	6	0.091013	0.005923	0.15725	0.022202
4	8	0.105002	0.008380	0.223872	0.020367
5	10	0.120260	0.011877	0.289849	0.019248
6	12	0.231559	0.004309	0.356866	0.017607
7	14	0.255346	0.005975	0.424072	0.016390
8	16	0.275489	0.007999	0.489967	0.015076
9	18	0.296834	0.010518	0.557026	0.013939
10	20	0.459183	0.006081	0.623746	0.013318

Theorem 5.2. *Let $B_h(C,0) \leqslant p_h$ and $B_h(C,1) \geqslant 1$, then the algorithm given in* Fig. 8 *minimizes the value of $B_n(C,\pi)$ while the constraint $B_h(C,\pi) \leqslant p_h$ is satisfied.*

Proof. Using Theorem 5.1, it follows that there is a unique π^* which satisfies the conditions of the theorem. Since $B_h(C,\pi)$ is strictly increasing and $B_n(C,\pi)$ is strictly decreasing, both with respect to π, the largest value of π that satisfies condition $B_h(C,\pi) \leqslant p_h$ is the optimal π, that is π^*. Hence the algorithm starts with largest value of π, which is one, and uses binary search to find π^*. $\square$

5.2. Performance of uniform fractional channel policy

In this section, we study the performance of the UFC policy. In order to study the performance of the UFC policy, we analytically compare it with guard channel policy [6]. Since there is a unique π^* (T^*) that minimizes $B_n(C,\pi)$ ($B_n(C,T)$) and satisfies constraint $B_h(C,\pi) \leqslant p_h$ ($B_h(C,T) \leqslant p_h$) [9], we only study the performance of guard channel and uniform fractional channel policies at their optimal points π^* (T^*). In order to simplify our presentation, we use the superscripts π^* and T^* to discriminate different parameters for these two policies. At the optimal points, the dropping probabilities of two schemes are equal, i.e., $B_h(C,\pi^*) = B_h(C,T^*)$. Thus, we have

$$\begin{aligned}
P_0^{T^*} &= \frac{B_h(C,T^*)}{\dfrac{\rho^C \alpha^{C-T^*}}{C!}}, \\
&= \frac{\dfrac{\rho^C \gamma^C}{C!} P_0^{\pi^*}}{\dfrac{\rho^C \alpha^{C-T^*}}{C!}}, \\
&= \frac{\gamma^C P_0^{\pi^*}}{\alpha^{C-T^*}}, \\
&= \left(\frac{\gamma}{\alpha}\right)^{C-T^*} \gamma^{T^*} P_0^{\pi^*}, \\
&\geqslant \gamma^{T^*} P_0^{\pi^*}, \\
&\geqslant \alpha^{T^*} P_0^{\pi^*}.
\end{aligned} \tag{11}$$

Given the above inequality, the following theorem compares the performance of the GC and the UFC policies.

Theorem 5.3. *The UFC policy performs better than the guard channel policy when* $\pi^* \geqslant 1/2$ *(that is, a low handoff/new traffic ratio).*

Proof. We have

$$\begin{aligned} B_n(C,\pi^*) - B_n(C,T^*) &= (1-\pi^*)\sum_{n=0}^{C-1} p_n^{\pi^*} - \sum_{n=T^*+1}^{C-1} p_n^{T^*}, \\ &= (1-\pi^*)\sum_{n=0}^{T^*} p_n^{\pi^*} + \sum_{n=T^*+1}^{C-1} \frac{\rho^n}{n!}\Big[(1-\pi^*)\gamma^n P_0^{\pi^*} - \alpha^{n-T^*} P_0^{T^*}\Big], \\ &\leqslant (1-\pi^*)\sum_{n=0}^{T^*} p_n^{\pi^*} + \sum_{n=T^*+1}^{C-1} \frac{\rho^n \alpha^{n-T^*}}{n!} P_0^{T^*}\Big[(1-\pi^*)\Big(\frac{\gamma}{\alpha}\Big)^{n-T^*} - 1\Big], \\ &\leqslant (1-\pi^*) + \Big[(1-\pi^*)\Big(\frac{\gamma}{\alpha}\Big)^{C-T^*-1} - 1\Big] \sum_{n=T^*+1}^{C-1} \frac{\rho^n \alpha^{n-T^*}}{n!} P_0^{T^*}, \\ &\leqslant (1-\pi^*)\Big(\frac{\gamma}{\alpha}\Big)^{C-T^*-1} - \pi^*. \end{aligned} \tag{12}$$

By setting the difference of the blocking probabilities for two policies less than zero (i.e., $B_n(C,\pi^*) - B_n(C,T^*) \leqslant 0$), we obtain

$$\lambda_n \leqslant \frac{\lambda_h}{\pi^*}\Big[\sqrt[m]{\frac{\pi^*}{1-\pi^*}} - 1\Big], \tag{13}$$

where $m = C - T^* - 1$. Since the right hand side of inequality (13) must be positive, we obtain

$$\frac{\pi^*}{1-\pi^*} \geqslant 1,$$

which results $\pi^* \geqslant 1/2$. This implies that less channels are allocated to the handoff calls, or equivalently the handoff traffic is low in comparison to the traffics for new calls and hence the theorem. □

6. Simulation results

In this section, through simulation we compare performance of the guard channel and the uniform fractional channel policies. The results of simulations are summarized in Table 1. Simulation are conducted based on the single cell of homogenous cellular network system. In such network, each cell has 8 full duplex channels ($C = 8$). In all simulations, new call arrival rate is fixed to 30 calls per minute ($\lambda_n = 30$), channel holding time is set to 6 seconds ($\mu^{-1} = 6$), and the handoff call traffic is varied between 2 calls per minute to 20 calls per minute. The results listed in Table 1 are obtained by averaging 10 runs from 2 000 000 seconds simulation of each algorithm. The level of QoS for the dropping probability of handoff calls is set to 0.01. The optimal number of guard channels for guard channel policy is obtained by algorithm given in [5].

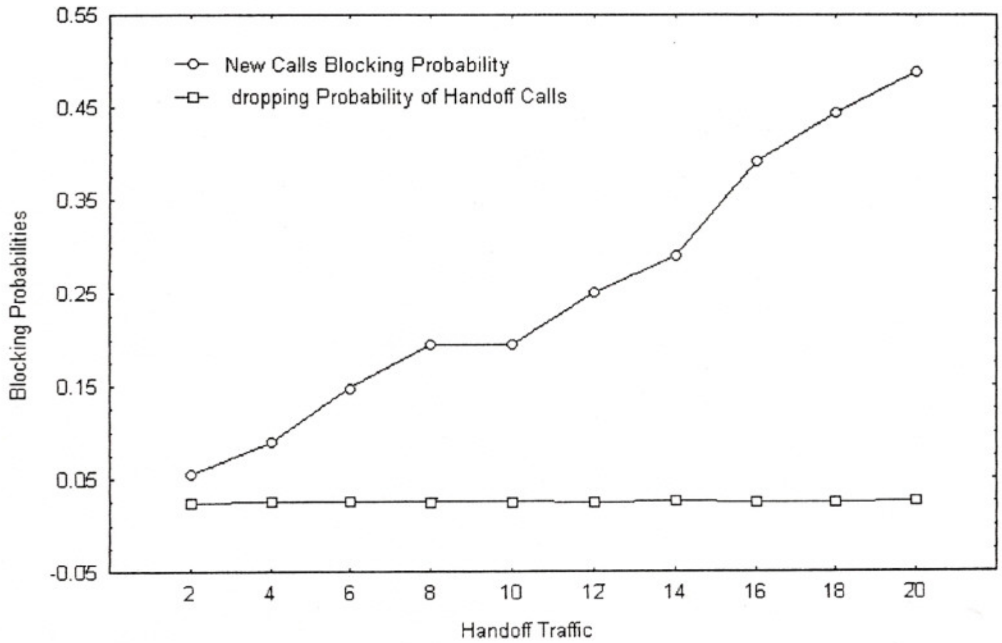

Fig. 9. Performance of the proposed algorithm for different handoff traffic.

By inspecting Table 1, it is evident that the blocking probability of new calls for uniform fractional channel policy is less than the blocking probability of new calls for guard channel policy when the handoff traffic is low. Figure 9 shows the performance of the UFC policy under different handoff traffics when the other parameters of the cell are fixed.

7. Conclusions

In this paper, we have studied a subclass of fractional channel policy, called uniform fractional channel policy. Expressions for both dropping probability of handoff calls and blocking probability of new calls were derived. We also gave an algorithm for finding the optimal parameter of uniform fractional channel policy. Then the uniform fractional channel policy compared with guard channel policy and shown that guard channel policy performs better than the uniform fractional channel policy under the low handoff/new traffic ratio. In order to confirm our analytical results, the computer simulations were conducted.

Acknowledgements

The authors would like to thank the referees for their suggestions and comments. This research was in part supported by a grant from Institute for Studies in Theoretical Physics and Mathematics (IPM), Tehran, Iran.

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