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(54) METHOD FOR PARTITIONING RESOURCE SPACE, ASSIGNING PHYSICAL CHANNEL, AND ALLOCATING POWER IN OFDMA-BASED CELLULAR SYSTEM

VERFAHREN ZUM AUFTEILEN DES BETRIEBSMITTELRAUMES, ZUWEISEN DES PHYSISCHEN KANALS UND ZUTEILEN VON LEISTUNG IN EINEM AUF OFDMA BASISIERENDEN ZELLULAREN SYSTEM

PROCEDE DE DECOUPAGE D’ESPACES DE RESSOURCE, D’ATTRIBUTION DE CANAUX PHYSIQUES ET D’AFFECTATION DE PUISSANCE DANS UN SYSTEME CELLULAIRE A ACCES MULTIPLE PAR REPARTITION ORTHOGONALE DE LA FREQUENCE (OFDMA)

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(56) References cited:

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Description

Technical Field

[0001] The present invention relates to an OFDMA (Orthogonal Frequency Division Multiple Access)-based cellular system. More specifically, the present invention relates to a method for partitioning resource spaces, assigning physical channels, and allocating power in an OFDMA-based cellular system for configuring a physical link resource with a plurality of resource spaces, and configuring a resource space with a plurality of resource subspaces to easily control inter-cell interference for each channel characteristic in an OFDMA-based cellular system.

Background Art

[0002] In general, ISI (Inter-Symbol Interference) according to multiple paths is generated to receive signals when transmitting signals through a multi-path channel. In particular, the ISI is further reinforced in the case of high-speed data transmission since a symbol period is less than a delay spread of a channel, and hence, more complex receiving methods are required so as to compensate for distortion caused by the ISI and restore accurate transmit signals. In order to reduce a distortion phenomenon of signals caused by the ISI, the symbol period is to be greater than the delay spread of the channel, and the OFDM method has been proposed as a modulation method for simply compensating for the distortion of the multi-path channel.

[0003] The OFDM method uses a plurality of subcarrier shoving orthogonality to transmit data, differing from the transmission method which uses single carriers. That is, the OFDM method performs serial and parallel conversion on the input data by the number of subcarriers used for modulation, and modulates the respective converted data by using the corresponding subcarriers to thereby maintain data rates and increase the symbol period for each subcarrier by the number of subcarriers. Since the OFDM method uses subcarriers having orthogonality, it has better bandwidth efficiencies and longer symbol periods compared to the existing FDM (Frequency Division Multiplex) method, and it has an ISI-resistance characteristic compared to the single carrier modulation method.

[0004] The modulation and demodulation process at a transmitter and a receiver in the OFDM system corresponds to execution of IDFT (Inverse Discrete Fourier Transform) and DFT (Discrete Fourier Transform), an dft can also be realized effectively by using IFFT (Inverse Fast Fourier Transform) and FFT (Fast Fourier Transform). Further, when a guard interval which is longer than the delay spread of the channel is inserted for each symbol period, the inter-carrier orthogonality is maintained to generate no ICI (Inter-Carrier Interference), and no OFDM symbols caused by the multi-path channel are superimposed to completely eliminate adjacent inter-symbol ISI.

[0006] The conventional TDMA-based cellular system uses a different frequency in the adjacent cell to reduce interference by other cells. The method, however, reduces the total system capacity because of low frequency reuse efficiencies. The existing CDMA-based cellular system, such as the IS-95, the CDMA 2000, and the W-CDMA, uses spread spectrum codes to decrease interference caused by channels of other cells by the spread components, and averages the interference of various channels of the cells to use the identical frequency in the adjacent cell. However, the IEEE80211a, the Hiperlan/2, and the DAB (Digital Audio Broadcasting) on the conventional OFDM basis have been designed in environments other than that for the cellular system, and no consideration for reducing the inter-cell interference has been studied. In this instance, the inter-cell interference is reduced by using a different frequency in the adjacent cell, but the frequency reuse efficiencies are degraded, and the system capacity is decreased.

[0006] In order to improve the frequency reuse efficiencies in the above-noted OFDMA-based cellular system, the dynamic packet allocation method and the dynamic channel allocation method are used (refer to 'Network-assisted resource management for wireless data networks,' by X. Qiu, K. Chawla, J. C. I. Chuang, and N. Sollenberger, IEEE Selected Areas Commun., Vol.19, pp. 1222-1234, July 2001). Adjacent cells communicate with signaling, and they do not transmit data to the channel which another adjacent cell uses. This method gives good theoretical performance, but it is not appropriate for the actual systems because of a large amount of overheads.

[0007] Further, the OFDMA-based cellular system uses the frequency hopping method to average the inter-cell interference, and uses different frequency hopping patterns for the respective cells so that a channel of a cell may uniformly collide with many channels of another cell, and the inter-cell interference may accordingly be averaged, which is disclosed by the OFDMA method of the IEEE80216a. However, since the IEEE80216a averages the interference without distinguishing the channels, the required SNR (Signal to Noise Ratio) is also averaged since the channels are mixed, and hence, it is difficult to control the inter-cell interference.

Disclosure of Invention

Technical Problem

[0008] Technical Problem

[0009] It is an advantage of the present invention to provide a method for partitioning resource spaces and assigning channels and power for easily controlling inter-cell interference for respective channels having different characteristics, and enhancing frequency reuse efficiencies in an OFDMA-based cellular system.
Technical Solution

[0010] In one aspect of the present invention, a method for partitioning resource spaces and assigning physical channels and power in an OFDMA-based cellular system, comprises:

[0011] (a) partitioning a resource within a slot into resource spaces, in common in a plurality of adjacent cells;

[0012] (b) partitioning the partitioned resource spaces into resource sets according to respective sizes of physical channels in the adjacent cells; and

[0013] (c) assigning the physical channels classified based on characteristics to the partitioned resource sets within the resource space.

[0014] In another aspect of the present invention, a method for partitioning resource spaces and assigning physical channels and power in an OFDMA-based cellular system, comprises:

[0015] (a) partitioning a resource within a slot into resource spaces, in common in a plurality of adjacent cells;

[0016] (b) partitioning the partitioned resource spaces into resource subspaces, in common in the adjacent cells;

[0017] (c) partitioning the partitioned resource spaces and the resource subspaces into resource sets according to respective sizes of physical channels in the adjacent cells; and

[0018] (d) assigning the physical channels classified based on characteristics to the partitioned resource sets within the resource space and the resource subspace.

[0019] The resource space is partitioned so that a combination of the total or part of common channels, dedicated control channels, shared control channels, dedicated traffic channels, and shared traffic channels is allocated in a resource space.

[0020] The step (b) comprises partitioning the resource space through which the common channel, the dedicated control channel, and the shared control channel of each cell into resource subspaces so that the channels with similar physical channel characteristics may be transmitted at a subspace.

[0021] The resource set is partitioned to be collided as uniformly as possible with all the resource sets within the same resource space of another adjacent cell.

[0022] The resource set is partitioned to be collided as uniformly as possible with all the resource sets within one of the same resource space and the resource subspace of another adjacent cell.

[0023] The subcarriers which constitute the resource space are configured by a subcarrier set which covers wide frequency band and has a predetermined spacing between constituent adjacent sub-carriers.

[0024] The subcarrier which configures the resource space and the resource subspace is configured by a subcarrier set which covers at least one wide frequency band and has a predetermined interval.

[0025] The method comprises: allocating a transmit power to the resource space to a physical channel which uses a fixed transmit power from among the physical channels assigned to the resource set; and allocating a power within the maximum transmit power of the resource space to a physical channel which uses a variable transmit power from among the physical channels assigned to the resource set.

[0026] The method further comprises: allocating a transmit power of the resource subspace to a physical channel which uses a fixed transmit power from among the physical channels assigned to the resource set; and allocating a power within the maximum transmit power of the resource subspace to a physical channel which uses a variable transmit power from among the physical channels assigned to the resource set.

[0027] The transmit power is allocated by considering cell sizes, interference of adjacent cells, and a required SNR.

[0028] The maximum transmit power is allocated by considering cell sizes, interference of adjacent cells, and a required SNR.

[0029] The method further comprises: partitioning the resource space through which the traffic channel is transmitted into resource subspaces by the number of adjacent cells according to a cell arrangement; and allowing a transmit power higher than that of another resource subspace to a resource subspace for each cell, and differentiating the resource subspace with the allowed high transmit power for each adjacent cell.

[0030] A user who needs a high transmit power for each cell is allowed to use a traffic channel of the resource subspace with the allowed high transmit power.

Advantageous Effects

Brief Description of the Drawings

[0031] Description of Drawings
[0032] The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate an embodiment of the invention, and, together with the description, serve to explain the principles of the invention:

[0033] FIG. 1 shows a frame configuration of an OFDMA-based cellular system according to a preferred embodiment of the present invention;

[0034] FIG. 2 shows an exemplified schematic diagram for partitioning a resource space, a resource subspace, and a resource set according to a preferred embodiment of the present invention;

[0035] FIG. 3 shows an exemplified schematic diagram for assigning physical channels to respective resource sets in an OFDMA-based cellular system according to a preferred embodiment of the present invention;

[0036] FIG. 4 shows an exemplified partition of traffic resource sets when a resource space through which a traffic channel will be transmitted is not partitioned into resource subspaces in an OFDMA-based cellular system according to a preferred embodiment of the present in-
vention;

[0037] FIG. 5 shows a case for partitioning a resource space through which a traffic channel will be transmitted into a plurality of resource subspaces, and allowing different maximum transmit powers of the respective resource subspaces to increase frequency reuse efficiencies in an OFDMA-based cellular system according to a preferred embodiment of the present invention; and

[0038] FIG. 6 shows a flowchart for partitioning resource spaces, resource subspaces, and resource sets, and assigning physical channels and transmit powers in an OFDMA-based cellular system according to a preferred embodiment of the present invention.

Best Mode

[0039] In the following detailed description, only the preferred embodiment of the invention has been shown and described, simply by way of illustration of the best mode contemplated by the inventor(s) of carrying out the invention. As will be realized, the invention is capable of modification in various obvious respects, all without departing from the invention. Accordingly, the drawings and description are to be regarded as illustrative in nature, and not restrictive.

[0040] With reference to drawings, operations of partitioning resource spaces and assigning physical channels and power in an OFDMA-based cellular system according to a preferred embodiment of the present invention will be described.

[0041] FIG. 1 shows a frame configuration of an OFDMA-based cellular system according to a preferred embodiment of the present invention.

[0042] In an FDD (Frequency Division Duplex) system, physical link signals of an uplink and a downlink include slots 100a and 100b which continue with respect to time and are distinguishable by different frequency bands.

[0043] In a TDD (Time Division Duplex) system, the physical link signals use the same frequency band, and an uplink slot 100d and a downlink slot 100c are divided with respect to time.

[0044] Each slot 100a, 100b, 100c, and 100d includes resources 110 of as many as the product of a number of subcarriers used for transmission and a number of OFDM symbols within a slot. A length of a slot and number of resources within a slot can be fixed or variable.

[0045] FIG. 2 shows an exemplified schematic diagram for partitioning a resource space, a resource subspace, and a resource set according to a preferred embodiment of the present invention.

[0046] Referring to FIG. 2, the slot of the OFDMA-based cellular system is partitioned into resource spaces A (200), resource spaces B (201), and resource spaces C (202), and the resource spaces C are partitioned into first resource subspaces 210 and second resource subspaces 211.

[0047] Also, the resource space A is partitioned into three resource sets 221, the resource space B is partitioned into two resource sets 222, the first resource subspace is partitioned into six resource sets 223, and the second resource subspace is partitioned into six resource sets 224.

[0048] In this instance, adjacent cells Cell 1 and Cell 2 have the same resource spaces 200, 201, and 202 and resource subspaces 210 and 211, but the resource sets 221, 222, 223, and 224 are different, and a single resource set of a resource space of a single cell is arranged to be collided as uniformly as possible with the resource sets of the same resource space of another cell.

[0049] The arrangement is varied according to the number of the resource sets and the number of resources of a single resource set. For example, the arrangement can be performed according to pseudo random codes, and in particular, the resource sets of a cell can be uniformly arranged and superimposed on the resource sets of an adjacent cell by as many as the number obtained by dividing the number of resources of the resource sets by the number of resource sets, when a number of resource sets, a number of adjacent cells, and a number of resources of a single resource set are appropriately selected. One exemplar thereof is disclosed in 'Channel coding strategies for cellular radio' by G.J. Pottie and R. Calder bank, IEEE Trans. Vehic. Techn., Vol. 44, pp. 763-770, November 1995.

[0050] Differing from the above-described conventional patent and transaction, the preferred embodiment of the present invention is characterized in that the resource sets of an adjacent cell are collided as uniform as possible within a single resource space or a resource subspace, and the resource sets of different resource spaces or resource subspaces are not collided with each other.

[0051] Here, the methods of configuring the resource spaces or resource subspaces are not restricted by specific methods. That is, the different resource spaces can be distinguished by time or frequency with in a slot, and in general, the configuration is performed by combining the time and frequency distinguishings.

[0052] Also, frequency diversity is obtained by configuring subcarriers which constitute a single resource space or a resource subspace to a single subcarrier set or a plurality of subcarrier sets having a predetermined spacing and covering a wide frequency bandwidth, and reduces power consumption using a partial Fourier transform in the case of a mobile station for receiving physical channels provided in the corresponding resource space or resource subspace (refer to 'Multi-carrier digital communications: theory and application of OFDM' by A.R.S. Bahai and BR. Salzberg, Kluwer Academic, NJ, USA, pp.25-27 for the partial Fourier transform.)

[0053] FIG. 3 shows an exemplified schematic diagram for assigning physical channels to respective resource sets in an OFDMA-based cellular system according to a preferred embodiment of the present invention.

[0054] The cellular system generally includes a common channel 300 which is commonly used for the cells, a dedicated control channel 310 allocated to the users,
a dedicated traffic channel 320 allocated to the users, a
shared control channel 330 shared by part of the users,
and a shared traffic channel 340 shared by part of the
users, and for example, the dedicated control channel
310 from among the respective channel categories can
further be divided into channels 311 and 312 which have
different characteristics, such as receive powers, accord-
ing to functions, sizes, modulation methods, and coding
methods of the dedicated control channel 310. In this
instance, the common channel 300, the dedicated control
channel 310, and the shared control channel 330 which
have the same required receive power are transmitted in
a bundle through resource sets of a single resource
space or a resource subspace. That is, the channels of
an adjacent cell which influences the common channel
or the control channel of a cell are established to be chan-
nels which have characteristics, such as the required re-
cieve power, similar to the above-noted channels.

When the required receive power is different, the
transmit power becomes different, and when a chan-
nel with a greater transmit power and a channel with a
lesser transmit power are mixed, the channel with a less-
er transmit power is substantially interfered. However,
since the channels with similar transmit powers are in-
terfered in the preferred embodiment, the interference of
the adjacent cell is easily controlled.

Also, differing from the common channels and
the control channels, the traffic channels 340 use various
modulation methods and encoding methods according
to channel conditions and traffic amounts, and accord-
ingly, the resource space 350 through which the traffic
channels 340 are transmitted is partitioned into at least
one resource subspace 360, and the traffic channels are
transmitted through the resource sets 370 of the respec-
tive resource subspaces 360.

FIG. 3 shows a case of using two resource sub-
spaces, and when a single resource subspace 360,
through which the traffic channel 340 is transmitted, is
provided, the single traffic channel 340 is interfered by
all the traffic channels in the adjacent cell as uniformly
as possible, and when plural resource subspaces 360
are provided, the traffic channel 340 is interfered by the
traffic channel within the same resource subspace of the
adjacent cell.

Therefore, the effect of averaging the inter-cell
interference is the largest when a single resource sub-
pace is provided, but the transmit power of the resource
subspace through which the traffic channel is transmitted
for each cell is effectively controlled to thereby easily con-
trol the inter-cell interference, and the frequency reuse
efficiencies of the cellular system can be increased by
considering the control of the transmit power at the time
of configuring sectors and arranging the cells.

FIG. 4 shows an exemplified partition of traffic
resource sets when a resource space through which a
traffic channel will be transmitted is not partitioned into
resource subspaces in an OFDMA-based cellular system
according to a preferred embodiment of the present in-
vention.

Referring to FIG. 4, the resource space through
which the traffic channels will be transmitted is not par-
titioned into resource subspaces in the OFDMA-based
cellular system, but the traffic channel of a cell is control-
led to be collided as uniformly as possible with all the
traffic channels of another cell to thus average the inter-
cell interference.

That is, the traffic resource space 400 is parti-
tioned into a plurality of resource sets 410, and they are
allocated to the traffic channels 420. In this instance, the
resource sets 410 are partitioned for each cell so that the
traffic channels of a cell may be collided as uniformly as
possible with all the traffic channels of another cell.

FIG. 4 exemplifies a case of partitioning re-
source sets in the two cells so that the 0th resource set
430 of the Cell 0 may be uniformly collided with the six
resource sets of the Cell 4. This method is more ap-
propriate for the case in which the radius of the cell is large
when the traffic density is not high.

FIG. 5 shows a case for partitioning a resource
space through which a traffic channel will be transmitted
into a plurality of resource subspaces, and which allows
different maximum transmit powers of the respective re-
source subspaces to increase frequency reuse efficiencies
in an OFDMA-based cellular system according to a
preferred embodiment of the present invention. That is,
FIG. 5 shows a method for using a resource subspace
through which a plurality of traffic channels will be trans-
mitted, and which allows a transmit power in a single
resource subspace higher than a transmit power in anoth-
er resource subspace for each cell, thereby increasing the
frequency reuse efficiencies of the cellular system.

In detail, a traffic channel of a normal resource
subspace is assigned to a user 580 (a user who stays
within the cell), to whom it is able to transmit traffic chan-
nels with less power within a cell, and a traffic channel
of the resource subspace allowed with a high transmit
power is assigned to a user 590 (a user who stays on
the border of a cell), to whom it is required to transmit
them with high power. As a result, the user within the cell
is rarely interfered by the adjacent cell because of atten-
uation, and the user on the border the cell is rarely inter-
ferred by the adjacent cell since the adjacent cell does not
increase the power transmitted to the same resource
subspace in the adjacent cell.

In FIG. 5, a high power is allocated to the first
resource subspace 530 in Cell 0, and a normal power is
allocated to the second and third resource subspaces
540 and 550 when three traffic resource subspaces are
respectively used by the two cells Cell 0 and Cell 4.

In a like manner, a high power is allocated to the
second resource subspace 510 in Cell 4, and a nor-
mal power is allocated to the first and third resource sub-
spaces 500 and 520. Accordingly, in Cell 0, the traffic
channels are transmitted to the user 580 who stays in
the cell size 560 which is used for transmission with a
normal power through the second or third resource sub-
space (the first resource subspace can also be used), and the traffic channels are transmitted only through the first resource subspace to the user 590 who stays inside the cell size 570 which is used for transmission with a high power and stays outside the cell size 560 which is used for transmission with a normal power. In this instance, the user 580 who stays in the cell size 560 at the transmission with a normal power is less interfered by Cell 4 since the user 580 is far from Cell 4, and the user 590 who stays inside the cell size 570 at the transmission with a high power and stays outside the cell size 560 at the transmission with a normal power is less interfered since Cell 4 transmits a normal power to the corresponding resource subspace (the first resource subspace) even though the user 590 is not far from Cell 4.

Therefore, as given in FIG. 5, a system having a frequency reuse efficiency of 1 can be configured while maintaining the inter-cell interference similar to that of a system having a frequency reuse efficiency of 1/3. This method generates more effects by applying the number of traffic subspaces in consideration of cell arrangement and sector arrangement.

FIG. 6 shows a flowchart for partitioning resource spaces, resource subspaces, and resource sets, and assigning physical channels and transmit powers in an OFDMA-based cellular system according to a preferred embodiment of the present invention.

Referring to FIGs. 3 and 6, a resource within a slot is partitioned into resource spaces 350 in common from a plurality of adjacent cells so that a combination of part or all of the common channels 300, the dedicated control channels 310, the shared control channels 320, the dedicated traffic channels 330, and the shared traffic channels 340 is allocated in a resource space in step S610.

The partitioned resource spaces 350 are partitioned again into resource subspaces 360 in common in a plurality of adjacent cells if necessary in step S620. In this instance, the resource spaces through which the common channel, the dedicated control channel, and the shared control channel are transmitted can be partitioned into resource subspaces so that the channels having the similar physical channel characteristics may be transmitted in a single subspace.

The partitioned resource spaces 350 and the resource subspaces 360 are partitioned into resource sets 370 according to sizes of the respective physical channels in the adjacent cells so that are source set 370 within the resource space 350 or the resource subspace 360 may be collided as uniformly as possible with all the resource sets within the same resource space or resource subspace of another adjacent cell in step S630.

The physical channels having the similar characteristics are respectively assigned to the partitioned resource sets 370 within the resource space 350 or the resource subspace 360 in step S640.

A transmit power of the resource space 350 or the resource subspace 360 is assigned to the physical channel which uses a fixed transmit power from among the assigned physical channels in consideration of cell sizes, interference of adjacent cells, and required SNR in step S650.

A transmit within the maximum transmit power of the resource space 350 or the resource subspace 360 is assigned to the physical channel which uses a variable transmit power from among the assigned physical channels in consideration of cell sizes, interference of adjacent cells, and required SNR in step S660. In this instance, the subcarriers which constitute the resource space 350 or the resource subspace 360 can be configured by using at least one subcarrier set which covers a wide frequency band and has a predetermined spacing.

In addition, the resource space 350 through which the traffic channels are transmitted can be partitioned into resource subspaces 360 by the number of adjacent cells according to a cell arrangement, a transmit power higher than another resource subspace can be allowed to a resource subspace 360 for each cell, and the resource subspace 360 with the allowed high transmit power can be varied for each adjacent cell. Also, the user who needs a high transmit power for each above-noted cell is required to use the traffic channel of the resource subspace 360 having the allowed high transmit power, thereby reducing the interference of the adjacent cell and increase the frequency reuse efficiency.

Through the above-described method, a cell configuration or a cell reconfiguration for partitioning the resource space 350, the resource subspace 360, and the resource sets 370, and assigning the physical channels and the transmit power in the OFDMA-based cellular system can be executed.

As a result, the preferred embodiment of the present invention partitions a resource (a subcarrier within an OFDM symbol) into resource spaces, averages interference of the channels having similar characteristics in each resource space by using different frequency hopping patterns for the respective cells, and controls the power transmittable to the resource space for each cell, thereby easily controlling the inter-cell interference and increasing the frequency reuse efficiency.

Also, the inter-cell interference is easily controlled for respective channels with different characteristics in the OFDMA-based cellular system, and a method for partitioning the resource spaces and assigning the physical channels for improving the frequency reuse efficiency is provided, so that the common channels and the control channels having similar required SNRs between two different cells may be collided each other, thereby easily controlling the interference from the adjacent cells.

Further, the resource space for transmitting the traffic channels between the two different cells is partitioned into subspaces so that the traffic channels within the same subspace may be collided. Strict power control is performed between the collided channels to control the interference from the adjacent cells. Then the frequency reuse efficiency of the cellular system are in-
increased and thus the performance of the total system is
enhanced.

[0080] While this invention has been described in con-
nection with what is presently considered to be the most
practical and preferred embodiment, it is to be under-
stood that the invention is not limited to the disclosed
embodiments, but, on the contrary, is intended to cover
various modifications and equivalent arrangements in-
cluded within the spirit and scope of the appended claims.

Claims

1. A method for partitioning resource spaces and as-
signing physical channels and power in an OFDMA
(orthogonal frequency division multiple ac-
cess)-based cellular system, comprising:

(a) commonly partitioning a resource within a
slot (100a, 100b, 100c) in a plurality of adjacent
cells into resource spaces (200, 201, 201; 350);
(b) further partitioning the partitioned resource
spaces (200, 201, 201; 350) into resource sets
(200, 201, 201; 350) according to respective siz-
es of physical channels (200, 201, 201; 350) in
the adjacent cells; and
(c) assigning the physical channels (200, 201,
201; 350) classified based on physical channel
characteristics to the partitioned resource sets
(221, 222, 223, 224; 370) within the resource
space.

2. The method of claim 1, comprising the step (a1) of
further partitioning the partitioned resource spaces
(200, 201; 350) in a plurality of adjacent cells into
resource subspaces (210, 211; 360).

3. The method of claim 1 or 2, wherein the resource
space is partitioned so that a combination of the total
or part of common channels (300), dedicated control
channels 310, shared control channels (330), dedi-
cated traffic channels (320), and shared traffic chan-
nels (340) is allocated to a resource space.

4. The method of claim 2, wherein (a1) comprises part-
tioning the resource space through which the com-
mon channels (300), the dedicated control channels
(310), and the shared control channels (330), of each
cell into resource subspaces (200, 201, 201; 350)
so that the channels with similar physical channel
characteristics may be transmitted at a subspace.

5. The method of claim 1, wherein the resource set is
partitioned to be collided as uniformly as possible
with all the resource sets (221, 222, 223, 224; 370)
within the same resource space of another adjacent
cell.

6. The method of claim 2, wherein the resource set is
partitioned to be collided as uniformly as possible with all the resource sets (221, 222, 223, 224; 370) within one of the same resource
space and the resource subspace (210, 211; 360) of another adjacent cell.

7. The method of claim 1, wherein the subcarriers
which constitute the resource space is configured by
one or more subcarrier sets which covers at least
one wide frequency band and has a predetermined
spacings.

8. The method of claim 2, wherein the subcarriers,
which constitute the resource space and the re-
source subspace, is configured by one or more sub-
carrier sets which covers at least one wide frequency
band and has a predetermined spacings.

9. The method of claim 1, comprising: allocating a
transmit power of the resource space to a physical
channel which uses a fixed transmit power from
among the physical channels assigned to the re-
source set (221, 222, 223, 224; 370); and allocating
a power within the maximum transmit power of the
resource space to a physical channel which uses a
variable transmit power from among the physical
channels assigned to the resource set (222, 223,
224; 370).

10. The method of claim 2, comprising: allocating a
transmit power of the resource subspace to a physi-
cal channel which uses a fixed transmit power from
among the physical channels assigned to the re-
source set (221, 222, 223, 224; 370); and allocating
a power within the maximum transmit power of the
resource subspace (210, 211; 360) to a physical
channel which uses a variable transmit power from
among the physical channels assigned to the re-
source set (221, 222, 223, 224; 370).

11. The method of claim 9 or 10, wherein the transmit
power is allocated by considering cell sizes, interfer-
ence of adjacent cells, and a required SNR (signal
to noise ratio).

12. The method of claim 9 or 10, wherein the maximum
transmit power is allocated by considering cell sizes,
interference of adjacent cells, and a required SNR
(signal to noise ratio).

13. The method of claim 10, comprising: partitioning the
resource space through which the traffic channel is
transmitted into resource subspaces (210, 211; 360)
by the number of adjacent cells according to a cell ar-
rangement; and allowing a transmit power higher
than that of another resource subspace (210, 211;
360) to a resource subspace for each cell, and dif-
ferentiating the resource subspace with the allowed high transmit power for each adjacent cell.

14. The method of claim 10, wherein a user who needs a high transmit power for each cell is allowed to use a traffic channel of the resource subspace (210, 211; 360) with the allowed high transmit power.

Patentansprüche

1. Verfahren zum Partitionieren von Ressourcenräumen und zum Zuweisen physikalischer Kanäle und von Leistung in einem zellulären System auf OFDMA-Basis (auf Orthogonalfrequenzvielfachzugriff-Basis), das umfasst:

(a) gemeinsames Partitionieren einer Ressourcenraumeinheit eines Zeitschlitzes (100a, 100b, 100c) in mehreren benachbarten Zellen in Ressourcenräume (200, 201, 201; 350);
(b) weiterhin Partitionieren der partitionierten Ressourcenräume (200, 201, 201; 350) in Ressourcengruppen (200, 201, 201; 350) in Überlagerung mit jeweiligen Größen physikalischer Kanäle (200, 201, 201; 350) in den benachbarten Zellen; und
(c) zuweisen der physikalischen Kanäle (200, 201, 201; 350), die anhand von physikalischen Kanalcharakteristika klassifiziert sind, zu den partitionierten Ressourcengruppen (221, 222, 223; 370) in dem Ressourcenraum.

2. Verfahren nach Anspruch 1, das den Schritt (a1) des weiteren Partitionierens der partitionierten Ressourcenräume (200, 201, 201; 350) in mehreren benachbarten Zellen in Ressourcenunterräume (210, 211; 360) umfasst.

3. Verfahren nach Anspruch 1 oder 2, der Ressourceinheit so partitioniert wird, dass eine Kombination aus allen gemeinsamen Kanälen (300) oder einem Teil davon, dedizierte Steuerkanälen (310), gemeinsam genutzte Steuerkanäle (330), dedizierte Verkehrskanäle (320) und gemeinsam genutzte Verkehrskanäle (340) einem Ressourcenraum zugewiesen werden.

4. Verfahren nach Anspruch 2, wobei (a1) das Partitionieren des Ressourcenraums, durch den die gemeinsamen Kanäle (300), die dedizierten Steuerkanäle (310) und die gemeinsam genutzten Steuerkanäle (330) der Ressourcenunterräume (200, 201, 201; 350) partitioniert werden, derart ausgeführt wird, dass die Kanäle mit ähnlichen physikalischen Kanalcharakteristika in einem Unterraum übertragen werden können.

5. Verfahren nach Anspruch 1, wobei die Ressourcengruppe so partitioniert wird, dass sie mit allen Ressourcengruppen (221, 222, 223, 224; 370) in demselben Ressourcenraum einer weiteren benachbarten Zelle so gleichmäßig wie möglich zusammentrifft.

6. Verfahren nach Anspruch 2, wobei die Ressourcengruppe so partitioniert wird, dass sie mit allen Ressourcengruppen (221, 222, 223, 224; 370) entweder in demselben Ressourcenraum oder in dem Ressourcenuntraum (210, 211; 360) einer weiteren benachbarten Zelle so gleichmäßig wie möglich zusammentrifft.

7. Verfahren nach Anspruch 1, wobei die Unterträger, die den Ressourcenraum bilden, durch eine oder mehrere Unterträgergruppen konfiguriert sind, die wenigstens einen breiten Frequenzband abdecken und einen vorgegebenen Abstand haben.

8. Verfahren nach Anspruch 2, wobei die Unterträger, die den Ressourcenraum und den Ressourcenuntraum bilden, durch eine oder mehrere Unterträgergruppen konfiguriert sind, die wenigstens einen breiten Frequenzband abdecken und einen vorgegebenen Abstand haben.

9. Verfahren nach Anspruch 1, das umfasst: Zuweisen einer Sendeleistung des Ressourcenraums zu einem physikalischen Kanal, der eine feste Sendeleistung verwendet, unter den physikalischen Kanälen, die der Ressourcengruppe (221, 222, 223, 224; 370) zugewiesen sind; und Zuweisung einer Leistung innerhalb der maximalen Sendeleistung des Ressourcenraums zu einem physikalischen Kanal, der eine veränderliche Sendeleistung verwendet, unter den physikalischen Kanälen, die der Ressourcengruppe (221, 222, 223, 224; 370) zugewiesen sind.

10. Verfahren nach Anspruch 2, das umfasst: Zuweisen einer Sendeleistung des Ressourcenraums zu einem physikalischen Kanal, der eine feste Sendeleistung verwendet, unter den physikalischen Kanälen, die der Ressourcengruppe (221, 222, 223, 224; 370) zugewiesen sind; und Zuweisung einer Leistung innerhalb der maximalen Sendeleistung des Ressourcenraums (210, 211; 360) zu einem physikalischen Kanal, der eine veränderliche Sendeleistung verwendet, unter den physikalischen Kanälen, die der Ressourcengruppe (221, 222, 223, 224; 370) zugewiesen sind.

11. Verfahren nach Anspruch 9 oder 10, wobei die Sendeleistung unter Berücksichtigung von Zellengrößen, einer gegenseitigen Störung benachbarter Zellen und eines erforderlichen SNR (Rauschabstands) zugewiesen wird.
12. Verfahren nach Anspruch 9 oder 10, wobei die maximale Sendeleistung unter Berücksichtigung von Zellengrößen, einer gegenseitigen Störung benachbarter Zellen und eines erforderlichen SNR (Rauschabstands) zugewiesen wird.

13. Verfahren nach Anspruch 10, das umfasst: Partitionieren des Ressourcenraums, durch den der Verkehrskanal übertragen wird, in Ressourcenräume (210, 211; 360) anhand der Anzahl benachbarter Zellen in Übereinstimmung mit einer Zellenanordnung und Zulassen einer Sendeleistung, die höher als jene eines weiteren Ressourcenraums (210, 211; 360) ist, zu einem Ressourcenraum für jede Zelle und Unterscheidung des Ressourcenraums mit der zuglassenen hohen Sendeleistung für jede benachbarte Zelle.

14. Verfahren nach Anspruch 10, wobei ein Anwender, der eine hohe Sendeleistung für jede Zelle benötigt, einen Verkehrskanal des Ressourcenraums (210, 211; 360) mit der zuglassenen hohen Sendeleistung verwenden darf.

Revendications

1. Procédé pour diviser des espaces de ressources et attribuer des canaux physiques et une puissance dans un système cellulaire OFDMA (accès multiple par répartition en fréquence orthogonale), comprenant les étapes consistant à :

(a) diviser généralement une ressource dans une tranche (100a, 100b, 100c) dans une pluralité de cellules adjacentes en espaces de ressources (200, 201, 201 ; 350) :
(b) diviser davantage les espaces de ressources divisés (200, 201, 201 ; 350) en ensembles de ressources (200, 201, 201 ; 350) en fonction des tailles respectives des canaux physiques (200, 201, 201 ; 350) dans les cellules adjacentes et (c) attribuer les canaux physiques (200, 201, 201 ; 350) classés sur la base de caractéristiques de canal physique aux ensembles de ressources divisés (221, 222, 223, 224 ; 370) dans l’espace de ressources.

2. Procédé selon la revendication 1, comprenant l’étape (a1) de division supplémentaire des espaces de ressources divisés (200, 201, 201 ; 350) dans une pluralité de cellules adjacentes en sous-espaces de ressources (210, 211 ; 360).

3. Procédé selon la revendication 1 ou 2, dans lequel l’espace de ressources est divisé de sorte qu’une combinaison de la totalité ou d’une partie de canaux communs (300), de canaux de contrôle dédiés (310), de canaux de contrôle partagés (330), de canaux de trafic dédiés (320), et de canaux de trafic partagés (340) soit attribuée à un espace de ressources.

4. Procédé selon la revendication 2, dans lequel l’étape (a1) comprend la division de l’espace de ressources à travers lequel les canaux communs (300), les canaux de contrôle dédiés (310), et les canaux de contrôle partagés (330) de chaque cellule sont transmis dans des espaces de ressources (200, 201, 201 ; 350) de sorte que les canaux avec des caractéristiques de canal physique similaires puissent être transmis au niveau d’un sous-espace.

5. Procédé selon la revendication 1, dans lequel l’ensemble de ressources est divisé pour correspondre aussi uniformément que possible avec tous les ensembles de ressources (221, 222, 223, 224 ; 370) dans le même espace de ressources d’une autre cellule adjacente.

6. Procédé selon la revendication 2, dans lequel l’ensemble de ressources est divisé pour correspondre aussi uniformément que possible avec tous les ensembles de ressources (221, 222, 223, 224 ; 370) dans l’un du même espace de ressources et du sous-espace de ressources (210, 211 ; 360) d’une autre cellule adjacente.

7. Procédé selon la revendication 1, dans lequel les sous-porteuses qui constituent l’espace de ressources sont constituées d’un ou de plusieurs ensembles de sous-porteuses qui couvrent au moins une large bande de fréquences et qui ont un espacement prédéterminé.

8. Procédé selon la revendication 2, dans lequel les sous-porteuses, qui constituent l’espace de ressources et le sous-espace de ressources, sont constituées d’un ou de plusieurs ensembles de sous-porteuses qui couvrent au moins une large bande de fréquences et qui ont un espacement prédéterminé.

9. Procédé selon la revendication 1, comprenant les étapes consistent à : attribuer une puissance d’émission de l’espace de ressources à un canal physique qui utilise une puissance d’émission fixe parmi les canaux physiques attribués à l’ensemble de ressources (221, 222, 223, 224 ; 370) et attribuer une puissance dans les limites de la puissance d’émission maximum de l’espace de ressources à un canal physique qui utilise une puissance d’émission variable parmi les canaux physiques attribués à l’ensemble de ressources (221, 222, 223, 224 ; 370).

10. Procédé selon la revendication 2, comprenant les étapes consistent à : attribuer une puissance d’émission du sous-espace de ressources à un canal phy-
sique qui utilise une puissance d'émission fixe parmi les canaux physiques attribués à l'ensemble de ressources (221, 222, 223, 224 ; 370) ; et attribuer une puissance dans les limites de la puissance d'émission maximum du sous-espace de ressources (210, 211 ; 360) à un canal physique qui utilise une puissance d'émission variable parmi les canaux physiques attribués à l'ensemble de ressources (221, 222, 223, 224 ; 370).

11. Procédé selon la revendication 9 ou 10, dans lequel la puissance d'émission est attribuée en considérant les tailles des cellules, l'interférence de cellules adjacentes, et un SNR (rapport signal sur bruit) nécessaire.

12. Procédé selon la revendication 9 ou 10, dans lequel la puissance d'émission maximum est attribuée en considérant les tailles des cellules, l'interférence de cellules adjacentes, et un SNR (rapport signal sur bruit) nécessaire.

13. Procédé selon la revendication 10, comprenant les étapes consistant à : diviser l'espace de ressources à travers lequel le canal de trafic est transmis en sous-espaces de ressources (210, 211 ; 360) par le nombre de cellules adjacentes conformément à un agencement de cellules ; et autoriser une puissance d'émission supérieure à celle d'un autre sous-espace de ressources (210, 211 ; 360) pour un sous-espace de ressources pour chaque cellule, et différencier le sous-espace de ressources avec la grande puissance d'émission autorisée pour chaque cellule adjacente.

14. Procédé selon la revendication 10, dans lequel un utilisateur qui nécessite une grande puissance d'émission pour chaque cellule est autorisé à utiliser un canal de trafic du sous-espace de ressources (210, 211 ; 360) avec la grande puissance d'émission autorisée.
FIG. 6

Start

Partition resource within single slot into resource spaces commonly in adjacent cells

Partition resource spaces into resource subspaces commonly in adjacent cells

Partition resource spaces and resource subspaces into resource sets according to sizes of physical channels in adjacent cells

Assign physical channels with similar characteristics to resource sets in single resource space and resource subspace

Allocate Tx power to physical channel using fixed Tx power from among physical channels assigned to resource set

Allocate max Tx power to physical channel using variable Tx power from among physical channels assigned to resource set

End
REFERENCES CITED IN THE DESCRIPTION

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Non-patent literature cited in the description