METHODS FOR COMMUNICATION PROCESSING ~~METHODS~~ AND USER EQUIPMENT~~APPARATUSES, AND COMPUTER STORAGE MEDIUM~~

TECHNICAL FIELD

The disclosure relates to communication technologies, and more particularly, to a method and an apparatus for communication processing, and a computer storage medium.

BACKGROUND

In a New Radio (NR) system for 5th generation mobile networks or 5th generation wireless systems (referred to as 5G), especially when the communication frequency band is above 6GHz, there is a need to use beam-based transmission and reception to ensure a coverage range since the attenuation of high-frequency channels is relatively fast.

In the related art, only one of a plurality of transmission configuration indication (TCI) states is activated by a media access control (MAC) layer signaling corresponding to each control resource set (CORESET) for sending a physical downlink control channel (PDCCH) accordingly, where the TCI states are configured by a radio resource control (RRC) layer signaling. Then, the UE receives the PDCCH by using an optimal received beam (Rx beam), which is also used when a reference signal (RS) corresponding to a TCI state identifier is received. When the base station has a plurality of transmitter receiver points (TRPs), each TRP has one or more transmitting panels, or when the base station has only one TRP and the TRP has a plurality of transmitting panels, the plurality of panels may be used by the base station for sending data to the same user equipment (UE), and the plurality of panels may come from the same TRP or different TRPs of a cell, or may come from different cells. Similarly, when the UE also has a plurality of panels, which may be used by the UE for receiving data sent by the base station. Therefore, the reliability of the PDCCH needs to be further improved.

SUMMARY

The disclosure provides a method and an apparatus for communication processing, and a computer storage medium.

FIG. 5 is a second block diagram of an apparatus for communication processing according to an exemplary embodiment;

FIG. 6 is a block diagram of a device 800 for implementing communication processing according to an exemplary embodiment; and

FIG. 7 is a block diagram of a device 900 for implementing communication processing according to an exemplary embodiment.

DETAILED DESCRIPTION

Exemplary embodiments will be described in detail herein, examples of which are illustrated in the accompanying drawings. Where the following description refers to the drawings, the same numerals in different drawings refer to the same or similar elements unless otherwise indicated. The implementations described in the following exemplary embodiments do not represent all implementations consistent with the embodiments of the disclosure. Rather, they are merely examples of apparatuses and methods consistent with some aspects of the embodiments of the disclosure, as recited in the appended claims.

The terms used in the embodiments of the disclosure are ~~only~~ for the purpose of describing particular embodiments, and are not intended to limit the embodiments of the disclosure. As used in the embodiments of the disclosure and the appended claims, the singular forms "a," "an," and "the" are intended to include the plural forms as well, unless the context clearly dictates otherwise. It will also be understood that the term "and/or" as used herein refers to and includes any and all possible combinations of one or more of the associated listed items.

It should be understood that although the terms first, second, third, etc. may be used in embodiments of the disclosure to describe various pieces of information, such information should not be limited to these terms. These terms are ~~only~~ used to distinguish the same type of information from each other. For example, without departing from the scope of the embodiments of the disclosure, the first information may also be referred to as the second information, and similarly, the second information may also be referred to as the first information. Depending on the context, the words "if" and "in case" as used herein can be interpreted as "at the time of..." or "when..." or "in response to determining...".

At present, for beam-based reception, the base station indicates a TCI state of type D through a signaling, and informs the UE of the beam to be used when receiving. Each TCI state corresponds to an RS ID, where the RS may be a non-zero power (NZP) channel state information-reference signal (CSI-RS) resource, or a synchronization signal block (SSB), or may also be a sounding reference signal (SRS). So far, it is considered that the base station uses a panel for sending the PDCCH to the UE, in which the TCI states of the PDCCH are a list of TCI states configured by the RRC signaling for each CORESET and there are a plurality of TCI states (such as 64) on the list, the MAC signaling activates one of the plurality of TCI states configured by the RRC signaling for each CORESET. Then, when the base station sends the PDCCH to the UE, a received beam of a reference signal corresponding to the TCI state activated by the MAC is used by the UE to receive PDCCH on the CORESET resource. Currently for the PDCCH on one CORESET resource, the base station configures ~~only~~ one TCI state for the UE.

When the base station has a plurality of TRPs and each TRP has one or more transmitting panels, or when the base station has ~~only~~ one TRP and the TRP has a plurality of transmitting panels, the base station may simultaneously send the same PDCCH to the same UE by using the plurality of panels, which may be from the same TRP or different TRPs. That is, the PDCCH is repeatedly sent. Moreover, different cells may also repeatedly send the PDCCH to the same UE by using different panels. In this case, sending directions of different panels are different, so the UE also needs to receive the plurality of PDCCHs by using different panels, and the base station needs to indicate different TCI states to the UE, in which each TCI state corresponds to a received beam direction on each panel of the UE.

When a TCI state identifier of type D is given by a signaling, it is instructed the user receives the PDCCH by using the optimal received beam (Rx beam), which is also used when the RS corresponding to the TCI state identifier is received, as described in Table 1.

Table 1

TCI states	RS index	notes
TCI#0	SSB index#1	If the base station tells the UE to use TCI#0, it tells the UE to
TCI#1	SSB index#2	

TCI#2	CSI-RS index#5	receive the PDCCH by using the optimal Rx beam when receiving the SSB index#1
TCI#3	CSI-RS index#6	
…	…	

In the related art, for the CORESET for PDCCH transmission, the MAC signaling corresponding to each CORESET may ~~only~~ activate one of a plurality of TCI states configured by its RRC signaling, then the TCI state activated by the MAC signaling is used to determine the received beam when the UE receives the PDCCH sent on the CORESET.

When the base station configures a CORESET for the UE, a CORESET index may be configured (the CORESET index is identical for the CORESET from the same panel of the same TRP), a CORESET ID may be also configured, together with a time domain position and a frequency domain position occupied by the CORESET, and space domain resources (i.e., TCI states activated by the MAC signaling). The time domain is ~~only~~ configured with symbols and a starting symbol position is determined by a search space.

Based on the above wireless communication system, various embodiments of the disclosed method are proposed on how to improve the reliability of the PDCCH.

FIG. 2 is a first flow chart of a method for communication processing according to an exemplary embodiment. As shown in FIG. 2, the method for communication processing is used in a network device such as a base station, and includes the following steps.

In step S11, at least two time domain parameters and/or at least two received beams are configured for a user equipment (UE) to receive the same downlink control information (DCI).

In step S12, the DCI is sent to the UE via a physical downlink control channel (PDCCH) based on the at least two time domain parameters.

In this embodiment, the time domain parameter may refer to a PDCCH monitoring time domain parameter that appears in one cycle in a search space, or may refer to a PDCCH monitoring time domain parameter that appears in each cycle.

In this embodiment, the time domain parameter includes a time domain position.

configuration of CORESET corresponding to the search space. When there are more than two panels, the 14 bits are divided into more bit sets, and each bit set indicates a starting symbol position of the corresponding panel to send the PDCCH. Alternatively in another indication method, the within-slot monitoring-symbol position with a length of the 14-bit sequence is still ~~only~~ used to indicate the starting symbol position of the PDCCH, while for symbols in the time domain resource configuration of CORESET corresponding to the search space, a half of the symbols are used by one panel to send the PDCCH and the other half of the symbols are used by the other panel to send the PDCCH. Taking panel#0 and panel#1 as an example, the within-slot monitoring-symbol position corresponding to the search space is symbol #0 for example, and the number of symbols in the time domain resource configuration of CORESET corresponding to the search space is 4, then symbol #0 and symbol #1 are used by panel #0 to send the PDCCH for the UE, which corresponds to the first TCI state; symbol #2 and symbol #3 are used by panel #1 to send the PDCCH for the UE, which correspond to the second TCI state. When there are more than two panels, the time-domain symbols configured by the CORESET are divided into more symbol sets, and each symbol set is used by a corresponding panel to send the PDCCH for the terminal, which corresponds to a different TCI state. Therefore, for the DCI of the at least two different time domain parameters in the same search space, at least two different received beams need to be configured for the terminal.

The different panels may be different panels of the same TRP, or different panels of different TRPs, or different panels of different cells, which are not repeated in the specification later.

In this way, the at least two time domain parameters are indicated by configuring one search space for the UE.

In another embodiments, the at least two time domain parameters correspond to symbols within different slots in the search space.

Exemplarily, when the PDCCH monitoring-symbols appear in different slots, PDCCH monitoring-symbols in a first slot having PDCCH monitoring-symbols are used by a first panel to send the DCI for the terminal, and PDCCH monitoring-symbols in a second slot having PDCCH monitoring-symbols are used by a second panel to send the DCI for the

within-slot monitoring-symbol position is a number of symbols configured by CORESET. That is, for the two search spaces, PDCCH monitoring cycles are identical and PDCCH monitoring slot offsets are also identical but starting symbol positions are different. Thus, the PDCCH monitoring-symbols in the two search spaces are located in different symbol positions of the same slot.

In this way, the UE is informed to receive the at least two time domain parameters of the same DCI by using different beams, by configuring a search space and a relative offset value of the search space for the UE.

Considering that the at least two time domain parameters may belong to different search spaces, in some embodiments, the method further includes: configuring at least two search spaces for the UE, in which different time domain parameters in the at least two time domain parameters correspond to different search spaces.

Configuration of the search space includes configuration of the following parameters: a PDCCH monitoring cycle, a PDCCH monitoring slot offset value and a within-slot monitoring-symbol position.

The PDCCH monitoring cycle is N slots; the PDCCH monitoring slot offset value is M slots, where M is 0 to N-1; and the within-slot monitoring-symbol position indicates a starting symbol position of the CORESET, and determines a PDCCH monitoring-symbol position of the CORESET by adding a number of CORESET symbols to the starting symbol position of the CORESET.

In this way, by configuring different search spaces for the UE, the UE is informed to receive the at least two time domain parameters of the same DCI by using different beams.

Considering that ~~only~~ the number of occupied symbols is given in the CORESET configuration, which slot and a starting symbol position within the slot are determined by three parameters (i.e., the PDCCH monitoring cycle, the PDCCH monitoring slot offset value and the within-slot monitoring-symbol position) configured by the search space, so different panels may correspond to search spaces of different time domain parameters. Therefore, in some embodiments, the method further includes: configuring a control resource set (CORESET) for the UE, and the at least two search spaces correspond to the same

CORESET.

In the above solution, the method also includes: configuring a CORESET identifier for the CORESET, where the CORESET identifier is used to indicate that received beams corresponding to different search spaces in the CORESET are different.

In the above solution, among configuration parameters of the at least two search spaces, at least one of a PDCCH monitoring cycle parameter, a PDCCH monitoring slot offset parameter and a within-slot monitoring-symbol position parameter is different.

Exemplarily, the PDCCH monitoring cycles are identical, and the PDCCH monitoring slot offsets are different.

Exemplarily, the PDCCH monitoring cycles are different, and the PDCCH monitoring slot offsets are different.

Exemplarily, the PDCCH monitoring cycles are identical, the PDCCH monitoring slot offsets are identical, but the within-slot monitoring-symbol positions are different.

In this way, by configuring two search spaces in one CORESET for the UE, and configuring different TCI states for different search spaces, it may be achieved that different panels correspondingly use different time domain parameters of different search spaces to send the same DCI for the UE.

Considering that ~~only~~ the number of occupied symbols is given in the CORESET configuration, which slot and a starting symbol position within the slot are determined by three parameters (i.e., the PDCCH monitoring cycle, the PDCCH monitoring slot offset value and the within-slot monitoring-symbol position) configured by the search space, so different panels may correspond to different time domain parameters for different search spaces. Therefore, in some embodiments, the method further includes: configuring at least two CORESETs for the UE, and different search spaces in the at least two search spaces correspond to different CORESETs in the at least two CORESETs.

In other words, different search spaces correspond to different CORESETs.

In the above solution, frequency domain resources of the at least CORESETs are identical.

In the above solution, time domain resources of the at least two CORESETs are identical, and CORESET identifiers or cell identifiers of the at least two CORESETs are different.

component 922 is configured to execute instructions to perform the method for communication processing applied to the side of network device.

The device 900 may also include a power supply assembly 926 configured to perform power management of the device 900, a wired or wireless network interface 950 configured to connect the device 900 to a network, and an input output (I/O) interface 958. The device 900 may operate based on an operating system stored in the memory 932, such as Windows Server™, Mac OS X™, Unix™, Linux™, FreeBSD™ or the like.

The technical solutions described in the embodiments of the disclosure may be combined arbitrarily if there is no conflict.

Those skilled in the art will be aware of other embodiments of the disclosure after considering the specification and practicing the disclosure disclosed herein. The disclosure is intended to cover any variations, uses, or adaptive changes of the disclosure, which follow the general principles of the disclosure and include common knowledge or conventional technical means in the technical field not disclosed herein. The description and the embodiments are to be regarded as exemplary, and the true scope and spirit of the disclosure are indicated in the following claims.

It should be understood that the present disclosure is not limited to the precise structures described above and illustrated in the accompanying drawings, and that various modifications and changes may be made without departing from its scope. The scope of the present disclosure is limited ~~only~~ by the appended claims.

CLAIMS

1. A method for communication processing, ~~applied to~~performed by a network device, comprising:

configuring at least one of at least two time domain parameters ~~and/~~or at least two received beams for a user equipment (UE) to receive downlink control information (DCI), wherein each of the at least two time domain parameters includes a time domain position; and

sending the DCI to the UE via a physical downlink control channel (PDCCH) based on the at least two time domain parameters.

2. The method of claim 1, further comprising:

configuring a search space for the UE, wherein the at least two time domain parameters correspond to the ~~same~~ search space.

3. The method of claim 2, wherein the at least two time domain parameters correspond to different symbols within a slot in the search space.

4. The method of claim 2, wherein the at least two time domain parameters correspond to symbols within different slots in the search space.

5. The method of claim 1, further comprising:

configuring a search space for the UE, wherein a first time domain parameter in the at least two time domain parameters corresponds to the search space; and

configuring a relative offset value of the search space for the UE, wherein the relative offset value of the search space is an offset value of a second time domain parameter in the at least two time domain parameters relative to the first time domain parameter, ~~.~~ and

~~6. The method of claim 5, wherein~~ the relative offset value of the search space comprises:

one or more combinations of a relative offset value of a PDCCH monitoring cycle, a relative offset value of a PDCCH monitoring slot offset value, and a relative offset value of a within-slot monitoring-symbol position.

~~7~~6. The method of claim 1, further comprising: configuring at least two search spaces for the UE, wherein different time domain parameters in the at least two time domain parameters

correspond to different search spaces.

~~8~~7. The method of any one of claims 2, 5 or ~~7~~6, wherein configuration of the search space comprises configuration of ~~the~~ following parameters:

a PDCCH monitoring cycle, a PDCCH monitoring slot offset value and a within-slot monitoring-symbol position.

~~9~~8. The method of claim ~~7~~6, further comprising:

configuring a control resource set for the UE, wherein the at least two search spaces correspond to the ~~same~~ control resource set.

~~10~~9. The method of claim ~~9~~8, further comprising:

configuring a control resource set identifier for the control resource set, wherein the control resource set identifier is configured to indicate that received beams corresponding to different search spaces in the control resource set are different.

~~11~~10. The method of claim ~~9~~8, wherein,

among configuration parameters of the at least two search spaces, at least one of a PDCCH monitoring cycle ~~parameter~~, a PDCCH monitoring slot offset ~~parameter and~~ or a within-slot monitoring-symbol position ~~parameter~~ is different.

~~12~~11. The method of claim ~~7~~6, further comprising:

configuring at least two control resource sets for the UE, wherein different search spaces in the at least two search spaces correspond to different control resource sets in the at least two control resource sets.

~~13~~12. The method of claim ~~12~~11, wherein,

frequency domain resources of the at least two control resource sets are identical.

~~14~~13. The method of claim ~~13~~12, wherein time domain resources of the at least two control resource sets are identical, and control resource set identifiers or cell identifiers of the at least two control resource sets are different.

~~15. The method of any one of claims 1-14, further comprising:~~

~~for the same search space, configuring at least two different received beams for the UE,~~

~~or~~

~~for different search spaces under the same control resource set, configuring different received beams for the UE, or~~

~~for different control resource sets, configuring different received beams for the UE.~~

~~16. The method of claim 15, wherein,~~

~~the different received beams are configured for the UE to receive DCI from different cells, or DCI from different transmitter receiver points (TRPs) in the same cell, or DCI from different antenna panels of the same TRP.~~

~~17.The method of claim 1, further comprising:~~

~~sending a configuration signaling, wherein the configuration signaling is configured to notify the UE that DCI to be received with different received beams under the at least two time domain parameters is identical.~~

~~18~~14. The method of claim 1, further comprising:

sending a signaling that includes a transmission configuration indication (TCI) state, wherein the TCI state comprises one of TCI state information of at least one cell, ~~or~~ TCI state information of at least one TRP in a cell, ~~or~~ and TCI state information of at least one antenna panel of a TRP.

~~19~~15. A method for communication processing, performed by~~applied to~~ a user equipment (UE), comprising:

determining at least one of at least two time domain parameters ~~and/~~or at least two received beams to receive downlink control information (DCI), wherein each of the at least two time domain parameters includes a time domain position; and

receiving the DCI with different received beams based on different time domain parameters in the at least two time domain parameters, wherein the DCI is sent by a network device via a physical downlink control channel (PDCCH) based on the different time domain parameters.

~~20. The method of claim 19, further comprising:~~

~~determining a search space configured by the network device, wherein the at least two time domain parameters correspond to the same search space.~~

~~21. The method of claim 20, wherein the at least two time domain parameters correspond to different symbols within a slot in the search space.~~

~~22. The method of claim 20, wherein the at least two time domain parameters correspond to symbols within different slots in the search space.~~

~~23. The method of claim 19, further comprising:~~

~~determining a search space and a relative offset value of the search space configured by the network device, wherein a first time domain parameter in the at least two time domain parameters corresponds to the search space, and the relative offset value of the search space is an offset value of a second time domain parameter in the at least two time domain parameters relative to the first time domain parameter;~~

~~the second time domain parameter in the at least two time domain parameters is determined based on the search space and the relative offset value of the search space.~~

~~24. The method of claim 23, wherein the relative offset value of the search space comprises:~~

~~one or more combinations of a relative offset value of a PDCCH monitoring cycle, a relative offset value of a PDCCH monitoring slot offset value, and a relative offset value of a within-slot monitoring symbol position.~~

~~25~~16. The method of claim ~~19~~15, further comprising:

determining at least two search spaces configured by the network device, wherein different time domain parameters in the at least two time domain parameters correspond to different search spaces.

~~26~~17. The method of claim ~~20~~16, wherein configuration of the search space comprises configuration of the following parameters:

a PDCCH monitoring cycle, a PDCCH monitoring slot offset value and a within-slot monitoring-symbol position.

~~27. The method of claim 25, further comprising:~~

~~determining a control resource set configured by the network device, wherein the at least two search spaces correspond to the same control resource set.~~

~~28. The method of claim 27, wherein determining the control resource set configured by the network device comprises:~~

~~determining a control resource set identifier, wherein different received beams corresponding to different search spaces in the control resource set are determined based on the control resource set identifier.~~

~~29. The method of claim 27, wherein,~~

~~among configuration parameters of the at least two search spaces, at least one of a PDCCH monitoring cycle parameter, a PDCCH monitoring slot offset parameter and a within slot monitoring symbol position parameter is different.~~

~~30~~18. The method of claim ~~25~~16, further comprising:

determining at least two control resource sets configured by the network device, wherein different search spaces in the at least two search spaces correspond to different control resource sets in the at least two control resource sets.

~~31. The method of claim 30, wherein,~~

~~frequency domain resources of the at least two control resource sets are identical.~~

~~32. The method of claim 31, wherein time domain resources of the at least two control resource sets are identical, and control resource set identifiers or cell identifiers of the at least two control resource sets are different.~~

~~33. The method of any one of claims 19-32, further comprising:~~

~~determining at least two different received beams configured by the network device for the same search space, or~~

~~determining different received beams configured by the network device for different search spaces under the same control resource set, or~~

~~determining different received beams configured by the network device for different~~

~~control resource sets.~~

~~34. The method of claim 33, wherein,~~

~~the different received beams are configured for the UE to receive DCI from different cells, or DCI from different transmitter receiver points (TRPs) in the same cell, or DCI from different antenna panels of the same TRP.~~

~~35. The method of claim 19, further comprising:~~

~~determining DCI to be sent by the network device via the PDCCH under the at least two time domain parameters is identical based on a configuration signaling.~~

~~36. The method of claim 19, further comprising:~~

~~receiving a signaling that includes a transmission configuration indication (TCI) state, and determining a received beam based on the TCI state.~~

~~37. An apparatus for communication processing, applied to network device, comprising:~~

~~a configuration unit, configured to set at least two time domain parameters and/or at least two received beams for a user equipment (UE) to receive the downlink control information (DCI); and~~

~~a first communication unit, configured to send the DCI to the UE via a physical downlink control channel (PDCCH) based on the at least two time domain parameters.~~

~~38. An apparatus for communication processing, applied to a user equipment (UE), comprising:~~

~~a determination unit, configured to determine at least two time domain parameters and/or at least two received beams to receive downlink control information (DCI); and~~

~~a second communication unit, configured to receive the DCI with different received beams based on different time domain parameters in the at least two time domain parameters, wherein the DCI is sent by a network device via a physical downlink control channel (PDCCH) based on the different time domain parameters.~~

~~39~~19. A network device ~~for communication processing~~, comprising:

a processor; and

a memory for storing executable instructions;

wherein when the executable instructions are executed, the processor is configured to implement the method for communication processing according to any one of claims 1 to ~~18~~15.

~~40~~20. A user equipment (UE) ~~device for communication processing~~, comprising:

a processor; and

a memory for storing executable instructions;

wherein when the executable instructions are executed, the processor is configured to implement the method for communication processing of claim~~s 19 to 36~~15.

~~41. A computer storage medium having executable instructions stored thereon, wherein when the executable instructions are executed by a processor, the processor is caused to execute the method for communication processing according to any one of claims 1 to 18.~~

~~42. A computer storage medium having executable instructions stored thereon, wherein when the executable instructions are executed by a processor, the processor is caused to execute the method for communication processing of claims 19 to 36.~~