

Method For Transmitting Uplink Control Channel, Terminal, and Base Station

The present application claims the priority to a PCT international application No. PCT/CN2017/108422, filed on October 30, 2017.

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Technical Field

The present application relates to a wireless communication technology, in particular to a technology for uplink control channel transmission.

10 Background

The current 5G NR (new radio) system supports physical uplink control channels PUCCH of two time lengths, that is, a short-PUCCH and a long-PUCCH. The short-PUCCH includes 1 or 2 time domain symbols, and the long-PUCCH includes 4-14 time domain symbols. Uplink control channel Parameters (e.g., period, offset, PUCCH resources, etc.) for transmitting an uplink scheduling request (SR) are usually semi-statically configured. The scheduling request adopts an on-off transmission mechanism, that is, a PUCCH is transmitted on a corresponding resource when a terminal has a scheduling request, and no information is sent on the corresponding resource when the terminal has no scheduling request. For the transmission of a scheduling request (SR), it is concluded that a transmission period of an SR is at least equal to X OFDM symbols (at least for the SR transmitted by using a short-PUCCH), and the value of X is assumed as 1 in the current operation.

When a period of the SR is very short, there will be multiple transmission resources of the SR in one slot (including 14 symbols). When other uplink control information transmitted by using a long-PUCCH is transmitted in the slot at the same time, since there are multiple transmission resources of the SR in the time domain, the base station cannot rely on scheduling to avoid SR collisions in other uplink control information domains, and the following situations may occur:

1. The transmission duration of the other uplink control information by using the PUCCH

is greater than the transmission duration of the SR by using a short-PUCCH(as shown in FIG. 1).

2. The two channels partially overlap in the time domain (as shown in FIG. 2).

In this case, if information of the SR is embedded into a channel, which is for transmitting the other uplink control information, for transmitting, the transmission delay of the SR will be increased, which is unacceptable for delay-sensitive services. Therefore, there is no clear solution for how a terminal that cannot support simultaneous transmission of multiple uplink control channels operates in this case.

10 Summary

The purpose of the present application is to provide an uplink control channel transmission method, a terminal, and a base station, so as to solve the problem that SR transmission delay may increase and requirements of delay-sensitive services cannot be satisfied.

In order to solve the above problem, the present application discloses an uplink control channel transmission method, including: determining, by a terminal, a period and a physical resource for transmitting an uplink scheduling request; determining, by the terminal, to use a target uplink control channel for transmitting other uplink control information; and determining, by the terminal, a multiplexing transmission mode of the uplink scheduling request and the other uplink control information according to a relationship between the period and a transmission duration of the target uplink control channel.

The present application also discloses an uplink control channel transmission method, including: determining, by a base station, a period and a physical resource for receiving an uplink scheduling request; determining, by the base station, to use a target uplink control channel for receiving other uplink control information; and determining, by the base station, a multiplexing transmission mode of the uplink scheduling request and the other uplink control information according to a relationship between the period and a transmission duration of the target uplink control channel.

The present application also discloses a terminal, which includes: a first module, a second module, and a third module.

The first module is configured to determine a period and a physical resource for transmitting an uplink scheduling request.

5 The second module is configured to determine to use a target uplink control channel for transmitting other uplink control information.

The third module is configured to determine a multiplexing transmission mode of the uplink scheduling request and the other uplink control information according to a relationship between the period and a transmission duration of the target uplink control channel.

10 The present application also discloses a base station, which includes: a fourth module, a fifth module, and a sixth module.

The fourth module is configured to determine a period and a physical resource for receiving an uplink scheduling request.

15 The fifth module is configured to determine to use a target uplink control channel for receiving other uplink control information.

The sixth module is configured to determine a multiplexing transmission mode of the uplink scheduling request and the other uplink control information according to a relationship between the period and a transmission duration of the target uplink control channel.

20 The present application also discloses an uplink control channel transmission method, including: determining, by a terminal, a period and a physical resource for transmitting an uplink scheduling request; determining, by the terminal, to use a target uplink control channel for transmitting other uplink control information; and determining, by the terminal, to transmit the uplink scheduling request when it is determined that the period is less than or equal to a preset sixth threshold and the uplink scheduling request is positive.

25 The present application also discloses an uplink control channel transmission method, including: determining, by a base station, a period and a physical resource for receiving an uplink scheduling request; determining, by the base station, to use a target uplink control channel for receiving other uplink control information; and determining, by the base station, to

receive the uplink scheduling request when it is determined that the period is less than or equal to a preset sixth threshold and the uplink scheduling request is positive.

The present application also discloses a terminal, which includes: a ninth module, a tenth module, and an eleventh module.

5 The ninth module is configured to determine a period and a physical resource for transmitting an uplink scheduling request.

The tenth module is configured to determine to use the target uplink control channel for transmitting other uplink control information.

10 The eleventh module is configured to determine to transmit the uplink scheduling request when it is determined that the period is less than or equal to a preset sixth threshold and the uplink scheduling request is positive.

The present application also discloses a base station, which includes: a twelfth module, a thirteenth module, and a fourteenth module.

15 The twelfth module is configured to determine a period and a physical resource for receiving an uplink scheduling request.

The thirteenth module is configured to determine to use a target uplink control channel for receiving other uplink control information.

20 The fourteenth module is configured to determine to receive the uplink scheduling request when it is determined that the period is less than or equal to a preset sixth threshold and the uplink scheduling request is positive.

The present application also discloses a terminal, which includes: a memory and a processor.

The memory is configured to store computer-executable instructions.

25 The processor is configured to implement acts of the above uplink control channel transmission methods when the computer-executable instructions are executed.

The present application also discloses a computer-readable storage medium, wherein the computer-executable instructions are stored in the computer-readable storage medium, and the computer-executable instructions, when executed by a processor, implement the acts of the

above uplink control channel transmission methods.

The present application also discloses a base station, which includes: a memory and a processor.

The memory is configured to store computer-executable instructions.

5 The processor is configured to implement various acts of the above uplink control channel transmission methods when the computer-executable instructions are executed.

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10 above uplink control channel transmission methods.

Compared with the prior art, with an embodiment of the present application, an SR transmission delay of a delay-sensitive service may not be increased for a terminal which does not support simultaneous transmission of multiple uplink control channels.

A large number of technical features are recorded in the specification of the application
15 and distributed in various technical solutions. If all possible combinations of technical features (i.e. technical solutions) of the present application are listed, the specification will be too lengthy. In order to avoid this problem, various technical features disclosed in the above summary of the present application, various technical features disclosed in the following embodiments and examples, and various technical features disclosed in the drawings can be
20 combined freely with each other to form various new technical solutions (all of which are deemed to have been recorded in this specification), unless such combination of technical features is not technically feasible. For example, the feature A+B+C is disclosed in one example, the feature A+B+D+E is disclosed in another example. The features C and D are equivalent technical means that play the same role, technically, it is only needed to choose one
25 of the features C and D, and they cannot be used at the same time, and the feature E can be technically combined with the feature C. Then, the solution of A+B+C+D should not be considered as already being recorded because of the technical infeasibility, while the solution of A+B+C+E should be considered as already being recorded.

Brief Description of Drawings

FIG. 1 is a schematic diagram of the prior art where the transmission duration of other uplink control information by using a PUCCH is greater than the transmission duration of an SR by using a short-PUCCH.

5 FIG. 2 is a schematic diagram of a partial overlap of an SR transmission channel and other uplink control information transmission channel in a time domain in the prior art.

FIG. 3 is a schematic flowchart of an uplink control channel transmission method at a terminal side in a first embodiment of the present invention.

10 FIG. 4 is a schematic flowchart of an uplink control channel transmission method at a base station side in a second embodiment of the present invention.

FIG. 5 is a schematic diagram of a time-frequency resource used for uplink control channel transmission in an embodiment of the present invention (Method A).

FIG. 6 is a schematic diagram of a time-frequency resource used for uplink control channel transmission in an embodiment of the present invention (Method B).

15 FIG. 7 is a schematic diagram of a time-frequency resource used for uplink control channel transmission in an embodiment of the present invention (Method C).

FIG. 8 is a schematic diagram of a time-frequency resource used for uplink control channel transmission in an embodiment of the present invention (Method D).

20 FIG. 9 is a schematic diagram of an SR transmission method in an embodiment of the present invention.

Detailed Description

In the following description, many technical details are set forth so as to enable the reader to better understand the present application. However, those of ordinary skill in the art can
25 understand that the technical solution claimed in the present application can be realized even without these technical details and based on various changes and modifications of the following embodiments.

Description of some concepts and abbreviations in the present application is as follows:

5G: 5th Generation Mobile Communication Technology;

NR: an abbreviation for New Radio, which is a wireless access part of 5G (5th Generation Mobile Communication Technology);

5 PUCCH: an abbreviation for Physical Uplink Control Channel;

SR: plink Scheduling Request, an abbreviation of Scheduling Request;

OFDM: an abbreviation for Orthogonal Frequency Division Multiplexing;

T: a period for transmitting an uplink scheduling request;

P: a transmission duration of a target uplink control channel;

10 ACK/NACK information: feedback response information.

In order to make the object, technical solution and advantages of the present application clearer, embodiments of the present application will be described in further detail below with reference to the accompanying drawings.

15 A first embodiment of the present invention relates to an uplink control channel transmission method. FIG. 3 is a schematic flowchart of the uplink control channel transmission method.

In act 301, a terminal determines a period T and a physical resource for transmitting an uplink scheduling request.

20 In act 302, the terminal determines to use a target uplink control channel for transmitting other uplink control information.

In act 303, the terminal determines a multiplexing transmission mode of the SR and the other uplink control information according to a relationship between the T and a transmission duration P of the target uplink control channel.

25 By the above technical solution, an SR transmission delay of a delay-sensitive service may not be increased for a terminal which does not support simultaneous transmission of multiple uplink control channels.

The above acts 301 and 302 may be executed in an interchanged order or parallel order.

As mentioned in act 303, the terminal determines a multiplexing transmission mode of the SR and the other uplink control information according to the relationship between the T and P, and this can be implemented by various ways including a case where P takes any value (i.e., P= wildcard). There are some specific examples as follows.

5 Optionally, the act 303 may further include the following sub-acts: determining, by the terminal, that a first preset relationship between the T and the P is satisfied; and determining, by the terminal, that the SR and the other uplink control information are transmitted by multiplexing through the target uplink control channel. Optionally, after the SR and the other uplink control information are processed, the processed SR and the other uplink control
10 information are mapped into the target uplink control channel for transmission. The processing includes, but not limited to, concatenation, joint coding, interleaving, modulation and so on.

The first preset relationship has multiple implementation modes. Optionally, the first preset relationship includes: the P is less than or equal to $K \cdot T$ where $K > 0$, and/or a size of a frequency domain resource of the target uplink control channel is less than a size of a frequency
15 domain resource corresponding to the physical resource. Preferably, $K = 1$.

Optionally, the act 303 may further include the following sub-acts: determining, by the terminal, that a second preset relationship between the T and the P is satisfied; and determining, by the terminal, to use a first set of time symbols in the target uplink control channel for transmitting the other uplink control information.

20 When the second preset relationship is satisfied, there are various solutions for transmitting the SR and the other uplink control information. Here are the examples.

Solution A1: The terminal transmits the SR on the physical resource. The first set of time domain symbols are time domain symbols other than time domain symbols used for actually transmitting the SR in all time domain symbols in the target uplink control channel.

25 Solution B1: The terminal transmits the SR on the physical resource. The first set of time domain symbols are time domain symbols other than time domain symbols overlapping with the physical resource in all time domain symbols in the target uplink control channel.

Solution C1: The terminal transmits the SR on a second set of time symbols in a frequency domain resource where the target uplink control channel is located. The first set of

time domain symbols are time domain symbols other than the second set of time symbols in all time domain symbols in the target uplink control channel.

Solution D1: The terminal transmits the SR on a second set of time symbols in a frequency domain resource where the target uplink control channel is located. The first set of
 5 time domain symbols are time domain symbols other than time domain symbols overlapping with the physical resource in all time domain symbols in the target uplink control channel.

The second preset relationship has multiple implementation modes. Optionally, the second preset relationship includes: the P is greater than $S \cdot T$ where $S > 0$, and/or a size of a frequency domain resource of the target uplink control channel is greater than or equal to a size
 10 of a frequency domain resource corresponding to the physical resource. Preferably, $S = 1$. Optionally, $S = K$.

There are many ways to transmit other uplink control information. Optionally, the other uplink control information is mapped to the first set of time symbols for transmission after a number matching is performed according to the number of the first set of time symbols.
 15 Optionally, the other uplink control information is mapped to the first set of time symbols for transmission by puncturing.

Optionally, the act 303 may further include: the terminal determines that the target uplink control channel is a long physical uplink control channel, and the period is less than or equal to a preset first threshold, and the uplink scheduling request is positive. In this condition, the
 20 terminal uses a second set of time symbols in the target uplink control channel for transmitting the uplink scheduling request. There may be various solutions for transmitting an uplink scheduling request and other uplink control information, for example, Solution A1, Solution B1, Solution C1 and Solution D1 mentioned above.

Optionally, the act 303 may further include: the terminal determines that the target uplink
 25 control channel is a short physical uplink control channel, and the period is less than or equal to a preset second threshold, and the uplink scheduling request is positive. In this condition, the terminal uses a second set of time symbols in the target uplink control channel for transmitting the uplink scheduling request. There may be various solutions for transmitting an uplink scheduling request and other uplink control information, for example, Solution A1, Solution B1,

Solution C1 and Solution D1 mentioned above.

Optionally, the act 303 may further include: the terminal determines that the target uplink control channel is a physical uplink control channel of any length, and the period is less than or equal to a preset third threshold, and the uplink scheduling request is positive. In this condition, the terminal uses a second set of time symbols in the target uplink control channel for transmitting the uplink scheduling request. In one example, any length may be represented by a wildcard. In addition, there may be various solutions for transmitting an uplink scheduling request and other uplink control information, for example, Solution A1, Solution B1, Solution C1 and Solution D1 mentioned above.

Optionally, the act 303 may further include: the terminal determines that the target uplink control channel carries ACK/NACK information, and the uplink control channel is a physical uplink control channel of any length, and the period is less than or equal to a preset fourth threshold, and the uplink scheduling request is positive. In this condition, the terminal uses a second set of time symbols in the target uplink control channel for transmitting the uplink scheduling request. In one example, any length may be represented by a wildcard. In addition, there may be various solutions for transmitting an uplink scheduling request and other uplink control information, for example, Solution A1, Solution B1, Solution C1 and Solution D1 mentioned above.

Optionally, the act 303 may further include: the terminal determines that the period is less than or equal to a preset fifth threshold, and the uplink scheduling request is positive. In this condition, the terminal uses a second set of time symbols in the target uplink control channel for transmitting the uplink scheduling request. This condition is equivalent to the case where the transmission duration of the target uplink control channel may take any value. In addition, there may be various solutions for transmitting an uplink scheduling request and other uplink control information, for example, Solution A1, Solution B1, Solution C1 and Solution D1 mentioned above.

In the above-mentioned various combination conditions, “the uplink scheduling request is positive” may be optional.

A second embodiment of the present invention relates to an uplink control channel

transmission method. The first embodiment is the processing at a terminal side, and the second embodiment is the processing at a base station side corresponding to the first embodiment. FIG. 4 is a schematic flowchart of the uplink control channel transmission method.

5 In act 401, a base station determines a period T and a physical resource for an uplink scheduling request.

In act 402, the base station determines to use a target uplink control channel for transmitting other uplink control information.

10 In act 403, the base station determines a multiplexing transmission mode of the SR and the other uplink control information according to a relationship between the T and a transmission duration P of the target uplink control channel.

By the above technical solution, an SR transmission delay of a delay-sensitive service may not be increased for a base station which does not support simultaneous reception of multiple uplink control channels.

The above acts 401 and 402 may be executed in an interchanged order or parallel order.

15 Optionally, the act 403 may further include the following sub-acts: determining, by the base station, that a first preset relationship between the T and the P is satisfied; and determining, by the base station, that the SR and the other uplink control information are transmitted by multiplexing through the target uplink control channel. Optionally, the base station performs processing on a signal received from the target uplink control channel. The processing includes, 20 but not limited to, de-concatenation, joint decoding, de-interleaving, demodulation and so on.

The first preset relationship has multiple implementation modes. Optionally, the first preset relationship includes: the P is less than or equal to $K \cdot T$ where $K > 0$, and/or a size of a frequency domain resource of the target uplink control channel is less than a size of a frequency domain resource corresponding to the physical resource. Preferably, $K = 1$.

25 Optionally, the act 403 may further include the following sub-acts: determining, by the base station, that a second preset relationship between the T and the P is satisfied; and determining, by the base station, to use a first set of time symbols in the target uplink control channel for receiving the other uplink control information.

When the second preset relationship is satisfied, there are various solutions for transmitting the SR and the other uplink control information. Here are the examples.

Solution A2: The base station receives the SR on the physical resource. The first set of time domain symbols are time domain symbols other than time domain symbols used for actually receiving the SR in all time domain symbols in the target uplink control channel.

Solution B2: The base station receives the SR on the physical resource. The first set of time domain symbols are time domain symbols other than time domain symbols overlapping with the physical resource in all time domain symbols in the target uplink control channel.

Solution C2: The base station receives the SR on a second set of time symbols in a frequency domain resource where the target uplink control channel is located. The first set of time domain symbols are time domain symbols other than the second set of time symbols in all time domain symbols in the target uplink control channel.

Solution D2: The base station receives the SR on a second set of time symbols in a frequency domain resource where the target uplink control channel is located. The first set of time domain symbols are time domain symbols other than time domain symbols overlapping with the physical resource in all time domain symbols in the target uplink control channel.

The second preset relationship has multiple implementation modes. Optionally, the second preset relationship includes: the P is greater than $S \cdot T$ where $S > 0$, and/or a size of a frequency domain resource of the target uplink control channel is greater than or equal to a size of a frequency domain resource corresponding to the physical resource. Preferably, $S = 1$. Optionally, $S = K$.

Optionally, the act 403 may further include: the base station determines that the target uplink control channel is a long physical uplink control channel, and the period is less than or equal to a preset first threshold, and the uplink scheduling request is positive. In this condition, the base station uses a second set of time symbols in the target uplink control channel for receiving the uplink scheduling request. There may be various solutions for receiving an uplink scheduling request and other uplink control information, for example, Solution A2, Solution B2, Solution C2 and Solution D2 mentioned above.

Optionally, the act 403 may further include: the base station determines that the target

uplink control channel is a short physical uplink control channel, and the period is less than or equal to a preset second threshold, and the uplink scheduling request is positive. In this condition, the base station uses a second set of time symbols in the target uplink control channel for receiving the uplink scheduling request. There may be various solutions for receiving an uplink scheduling request and other uplink control information, for example, Solution A2, Solution B2, Solution C2 and Solution D2 mentioned above.

Optionally, the act 403 may further include: the base station determines that the target uplink control channel is a physical uplink control channel of any length, and the period is less than or equal to a preset third threshold, and the uplink scheduling request is positive. In this condition, the base station uses a second set of time symbols in the target uplink control channel for receiving the uplink scheduling request. In one example, any length may be represented by a wildcard. In addition, there may be various solutions for receiving an uplink scheduling request and other uplink control information, for example, Solution A2, Solution B2, Solution C2 and Solution D2 mentioned above.

Optionally, the act 403 may further include: the base station determines that the target uplink control channel carries ACK/NACK information, and the uplink control channel is a physical uplink control channel of any length, and the period is less than or equal to a preset fourth threshold, and the uplink scheduling request is positive. In this condition, the base station uses a second set of time symbols in the target uplink control channel for receiving the uplink scheduling request. In one example, any length may be represented by a wildcard. In addition, there may be various solutions for receiving an uplink scheduling request and other uplink control information, for example, Solution A2, Solution B2, Solution C2 and Solution D2 mentioned above.

Optionally, the act 403 may further include: the base station determines that the period is less than or equal to a preset fifth threshold, and the uplink scheduling request is positive. In this condition, the base station uses a second set of time symbols in the target uplink control channel for receiving the uplink scheduling request. This condition is equivalent to the case where the transmission duration of the target uplink control channel may take any value. In addition, there may be various solutions for receiving an uplink scheduling request and other

uplink control information, for example, Solution A2, Solution B2, Solution C2 and Solution D2 mentioned above.

In the above-mentioned various combination conditions, “the uplink scheduling request is positive” may be optional.

5 A third embodiment of the present invention relates to a terminal. The terminal includes: a first module, a second module, and a third module.

The first module is configured to determine a period and a physical resource for transmitting an uplink scheduling request.

10 The second module is configured to determine to use a target uplink control channel for transmitting other uplink control information.

The third module is configured to determine a multiplexing transmission mode of the uplink scheduling request and the other uplink control information according to a relationship between the period and a duration of the target uplink control channel.

Details are given below.

15 Optionally, the third module includes: a first sub-module and a second sub-module.

The first sub-module is configured to determine that a first preset relationship between the period and the transmission duration of the target uplink control channel is satisfied.

20 The second sub-module is configured to determine that the uplink scheduling request and the other uplink control information are transmitted by multiplexing through the target uplink control channel.

25 The first preset relationship includes: the transmission duration of the target uplink control channel is less than or equal to a product of K and the period of the uplink scheduling request, wherein $K > 0$; and/or a size of a frequency domain resource of the target uplink control channel is less than a size of a frequency domain resource corresponding to the physical resource.

Optionally, the third module includes: a third sub-module and a fourth sub-module.

The third sub-module is configured to determine that a second preset relationship between the period and the transmission duration of the target uplink control channel is satisfied.

The fourth sub-module is configured to determine to use a first set of time symbols in the target uplink control channel for transmitting the other uplink control information.

The second preset relationship includes: the transmission duration of the target uplink control channel is greater than a product of S and the period of the uplink scheduling request, wherein $S > 0$; and/or a size of a frequency domain resource of the target uplink control channel is greater than or equal to a size of a frequency domain resource corresponding to the physical resource.

Optionally, the third module includes a ninth sub-module, configured to determine to use a second set of time symbols in the target uplink control channel for transmitting the uplink scheduling request when it is determine that the target uplink control channel is a long physical uplink control channel, and the period is less than or equal to a preset first threshold, and the uplink scheduling request is positive.

Optionally, the third module includes a tenth sub-module, configured to determine to use a second set of time symbols in the target uplink control channel for transmitting the uplink scheduling request when it is determined that the target uplink control channel is a short physical uplink control channel, and the period is less than or equal to a preset second threshold, and the uplink scheduling request is positive.

Optionally, the third module includes an eleventh sub-module, configured to determine to use a second set of time symbols in the target uplink control channel for transmitting the uplink scheduling request when it is determined that the target uplink control channel is a physical uplink control channel of any length, and the period is less than or equal to a preset third threshold, and the uplink scheduling request is positive. In one example, any length may be represented by a wildcard.

Optionally, the third module includes a twelfth sub-module, configured to determine to use a second set of time symbols in the target uplink control channel for transmitting the uplink scheduling request when it is determined that the target uplink control channel carries ACK/NACK information, and the uplink control channel is a physical uplink control channel of any length, and the period is less than or equal to a preset fourth threshold, and the uplink scheduling request is positive. In one example, any length may be represented by a wildcard.

Optionally, the third module includes a thirteenth sub-module, configured to determine to use a second set of time symbols in the target uplink control channel for transmitting the uplink scheduling request when it is determined that the period is less than or equal to a preset fifth threshold, and the uplink scheduling request is positive (it is equivalent to the case where the transmission duration of the target uplink control channel may take any value).

In the above-mentioned various combination conditions, “the uplink scheduling request is positive” may be optional.

Resources used for transmitting an uplink scheduling request and other uplink control information may be implemented in various ways, and examples are as follows.

10 Optionally, the terminal transmits the uplink scheduling request on the physical resource. The first set of time domain symbols are time domain symbols other than time domain symbols used for actually transmitting the uplink scheduling request in all time domain symbols in the target uplink control channel.

15 Optionally, the terminal transmits the uplink scheduling request on the physical resource. The first set of time domain symbols are time domain symbols other than time domain symbols overlapping with the physical resource in all time domain symbols in the target uplink control channel.

20 Optionally, the terminal transmits the uplink scheduling request on a second set of time symbols in a frequency domain resource where the target uplink control channel is located, and the second set of time symbols are the same as time symbols occupied by the physical resource.

25 The first embodiment is a method embodiment corresponding to the present embodiment, and the present embodiment can be implemented in cooperation with the first embodiment. The relevant technical details mentioned in the first embodiment are still valid in the present embodiment, and will not be repeated here to reduce repetition. Accordingly, the relevant technical details mentioned in the present embodiment can also be applied in the first embodiment.

A fourth embodiment of the present invention relates to a base station. The base station includes: a fourth module, a fifth module, and a sixth module.

The fourth module is configured to determine a period and a physical resource for receiving an uplink scheduling request.

The fifth module is configured to determine to use a target uplink control channel for receiving other uplink control information.

- 5 The sixth module is configured to determine a multiplexing transmission mode of the uplink scheduling request and the other uplink control information according to a relationship between the period and a duration of the target uplink control channel.

Details are given below.

The sixth module includes: a fifth sub-module and a sixth sub-module.

- 10 The fifth sub-module is configured to determine that a first preset relationship between the period and the transmission duration of the target uplink control channel is satisfied.

The sixth sub-module is configured to determine that the uplink scheduling request and the other uplink control information are transmitted by multiplexing through the target uplink control channel.

- 15 The first preset relationship includes: the transmission duration of the target uplink control channel is less than or equal to a product of K and the period of the uplink scheduling request, wherein $K > 0$; and/or a size of a frequency domain resource of the target uplink control channel is less than a size of a frequency domain resource corresponding to the physical resource.

- 20 The sixth module includes: a seventh sub-module and an eighth sub-module.

The seventh sub-module is configured to determine that a second preset relationship between the period and the transmission duration of the target uplink control channel is satisfied.

- 25 The eighth sub-module is configured to determine to use a first set of time symbols in the target uplink control channel for receiving the other uplink control information.

The second preset relationship includes: the transmission duration of the target uplink control channel is greater than a product of S and the period of the uplink scheduling request, wherein $S > 0$; and/or a size of a frequency domain resource of the target uplink control channel

is greater than or equal to a size of a frequency domain resource corresponding to the physical resource.

Optionally, the sixth module includes a fourteenth sub-module, configured to determine to use a second set of time symbols in the target uplink control channel for receiving the uplink scheduling request when it is determined that the target uplink control channel is a long physical uplink control channel, and the period is less than or equal to a preset first threshold, and the uplink scheduling request is positive.

Optionally, the sixth module includes a fifteenth sub-module, configured to determine to use a second set of time symbols in the target uplink control channel for receiving the uplink scheduling request when it is determined that the target uplink control channel is a short physical uplink control channel, and the period is less than or equal to a preset second threshold, and the uplink scheduling request is positive.

Optionally, the sixth module includes a sixteenth sub-module, configured to determine to use a second set of time symbols in the target uplink control channel for receiving the uplink scheduling request when it is determined that the target uplink control channel is a physical uplink control channel of any length, and the period is less than or equal to a preset third threshold, and the uplink scheduling request is positive.

Optionally, the sixth module includes a seventeenth sub-module, configured to determine to use a second set of time symbols in the target uplink control channel for receiving the uplink scheduling request when it is determined that the target uplink control channel carries ACK/NACK information, and the uplink control channel is a physical uplink control channel of any length, and the period is less than or equal to a preset fourth threshold, and the uplink scheduling request is positive.

Optionally, the sixth module includes an eighteenth sub-module, configured to determine to use a second set of time symbols in the target uplink control channel for receiving the uplink scheduling request when it is determined that the period is less than or equal to a preset fifth threshold, and the uplink scheduling request is positive (it is equivalent to the case where the transmission duration of the target uplink control channel may take any value).

In the above-mentioned various combination conditions, “the uplink scheduling request is

positive” may be optional.

Resources used by the base station for receiving an uplink scheduling request and other uplink control information may be implemented in various ways.

5 Optionally, the base station receives the uplink scheduling request on the physical resource, and the first set of time domain symbols are time domain symbols other than time domain symbols used for actually transmitting the uplink scheduling request in all time domain symbols in the target uplink control channel.

10 Optionally, the base station receives the uplink scheduling request on the physical resource, and the first set of time domain symbols are time domain symbols other than time domain symbols overlapping with the physical resource in all time domain symbols in the target uplink control channel.

Optionally, the base station receives the uplink scheduling request on a second set of time symbols in a frequency domain resource where the target uplink control channel is located, and the second set of time symbols are the same as time symbols occupied by the physical resource.

15 The second embodiment is a method embodiment corresponding to the present embodiment, and the present embodiment can be implemented in cooperation with the second embodiment. The relevant technical details mentioned in the second embodiment are still valid in the present embodiment, and will not be repeated here to reduce repetition. Accordingly, the relevant technical details mentioned in the present embodiment can also be applied in the
20 second embodiment.

A fifth embodiment of the present invention relates to an uplink control channel transmission method, including the following acts: determining, by a terminal, a period and a physical resource for transmitting an uplink scheduling request; determining, by the terminal, to
25 use a target uplink control channel for transmitting other uplink control information; and determining, by the terminal, to transmit the uplink scheduling request when it is determined that the period is less than or equal to a preset sixth threshold, and the uplink scheduling request is positive. Wherein, “the uplink scheduling request is positive” may be optional.

The uplink scheduling request and other uplink control information are transmitted in various ways (the time symbols for transmitting other uplink control information in the target uplink control channel are referred to as the first set of time symbols, and the time symbols for transmitting the uplink scheduling request in the target uplink control channel are referred to as the second set of time symbols).

Optionally, the terminal transmits the uplink scheduling request on the physical resource, and the first set of time domain symbols are time domain symbols other than time domain symbols used for actually transmitting the uplink scheduling request in all time domain symbols in the target uplink control channel.

Optionally, the terminal transmits the uplink scheduling request on the physical resource, and the first set of time domain symbols are time domain symbols other than time domain symbols overlapping with the physical resource in all time domain symbols in the target uplink control channel.

Optionally, the second set of time symbols are the same as time symbols occupied by the physical resource.

This embodiment is a special case of the first embodiment, that is, the "relationship between the period and a transmission duration of the target uplink control channel" is specified as "the period is less than or equal to a preset sixth threshold". It can be understood that the transmission duration of the target uplink control channel may take any value (for example, the conditional expression can be expressed as: $T \leq \text{the sixth threshold AND } P = *$, where T is the period, P is the transmission duration of the target uplink control channel, $*$ is a wildcard). Relevant technical features in the first embodiment can be applied to this embodiment.

A sixth embodiment of the present invention relates to an uplink control channel transmission method, including the following acts: determining, by a base station, a period and a physical resource for receiving an uplink scheduling request; determining, by the base station, to use a target uplink control channel for receiving other uplink control information; and determining, by the base station, to receive the uplink scheduling request when it is determined that the period is less than or equal to a preset sixth threshold, and the uplink scheduling request is positive. Wherein, "the uplink scheduling request is positive" may be optional.

The uplink scheduling request and other uplink control information are received in various ways (the time symbols for receiving other uplink control information in the target uplink control channel are referred to as the first set of time symbols, and the time symbols for receiving the uplink scheduling request in the target uplink control channel are referred to as the
 5 second set of time symbols).

Optionally, the base station receives the uplink scheduling request on the physical resource, and the first set of time domain symbols are time domain symbols other than time domain symbols used for actually transmitting the uplink scheduling request in all time domain symbols in the target uplink control channel.

10 Optionally, the base station receives the uplink scheduling request on the physical resource, and the first set of time domain symbols are time domain symbols other than time domain symbols overlapping with the physical resource in all time domain symbols in the target uplink control channel.

15 Optionally, the second set of time symbols are the same as time symbols occupied by the physical resource.

This embodiment is a special case of the second embodiment, that is, the "relationship between the period and a transmission duration of the target uplink control channel" is specified as "the period is less than or equal to a preset sixth threshold". It can be understood that the transmission duration of the target uplink control channel may take any value (for example, the
 20 conditional expression can be expressed as: $T \leq \text{the sixth threshold AND } P = *$, where T is the period, P is the transmission duration of the target uplink control channel, * is a wildcard). Relevant technical features in the second embodiment can be applied to this embodiment.

A seventh embodiment of the present invention relates to a terminal including a ninth module, a tenth module, an eleventh module.

25 The ninth module is configured to determine a period and a physical resource for transmitting an uplink scheduling request.

The tenth module is configured to determine to use the target uplink control channel for transmitting other uplink control information.

The eleventh module is configured to determine to transmit the uplink scheduling request when it is determined that the period is less than or equal to a preset sixth threshold and the uplink scheduling request is positive. Wherein, “the uplink scheduling request is positive” may be optional.

5 The uplink scheduling request and other uplink control information are transmitted in various ways (the time symbols for transmitting other uplink control information in the target uplink control channel are referred to as the first set of time symbols, and the time symbols for transmitting the uplink scheduling request in the target uplink control channel are referred to as the second set of time symbols).

10 Optionally, the terminal transmits the uplink scheduling request on the physical resource, and the first set of time domain symbols are time domain symbols other than time domain symbols used for actually transmitting the uplink scheduling request in all time domain symbols in the target uplink control channel.

15 Optionally, the terminal transmits the uplink scheduling request on the physical resource, and the first set of time domain symbols are time domain symbols other than time domain symbols overlapping with the physical resource in all time domain symbols in the target uplink control channel.

Optionally, the second set of time symbols are the same as time symbols occupied by the physical resource.

20 This embodiment is a special case of the third embodiment. Relevant technical features in the third embodiment can be applied to this embodiment.

An eighth embodiment of the present invention relates to a base station including a twelfth module, a thirteenth module, and a fourteenth module.

25 The twelfth module is configured to determine a period and a physical resource for receiving an uplink scheduling request.

The thirteenth module is configured to determine to use a target uplink control channel for receiving other uplink control information.

The fourteenth module is configured to determine to receive the uplink scheduling request

when it is determined that the period is less than or equal to a preset sixth threshold and the uplink scheduling request is positive. Wherein, “the uplink scheduling request is positive” may be optional.

5 The uplink scheduling request and other uplink control information can be received in various ways (the time symbols for receiving other uplink control information in the target uplink control channel are referred to as the first set of time symbols, and the time symbols for receiving the uplink scheduling request in the target uplink control channel are referred to as the second set of time symbols).

10 Optionally, the base station receives the uplink scheduling request on the physical resource, and the first set of time domain symbols are time domain symbols other than time domain symbols used for actually transmitting the uplink scheduling request in all time domain symbols in the target uplink control channel.

15 Optionally, the base station receives the uplink scheduling request on the physical resource, and the first set of time domain symbols are time domain symbols other than time domain symbols overlapping with the physical resource in all time domain symbols in the target uplink control channel.

Optionally, the second set of time symbols are the same as time symbols occupied by the physical resource.

20 This embodiment is a special case of the fourth embodiment. Relevant technical features in the fourth embodiment can be applied to this embodiment.

A ninth embodiment of the present invention relates to a terminal including a memory and a processor.

The memory is configured to store computer-executable instructions.

25 The processor is configured to implement acts of the uplink control channel transmission method as described in the first or fifth embodiment when the computer-executable instructions are executed.

A tenth embodiment of the present invention relates to a base station, including a memory and a processor.

The memory is configured to store computer-executable instructions.

The processor is configured to implement acts of the uplink control channel transmission method as described in the second or sixth embodiment when the computer-executable instructions are executed.

5 In order to explain the technical solution of the present invention more clearly, the following provides a typical example.

The terminal judges whether the T and P satisfy the first preset relationship.

10 If the first preset relationship is satisfied, the terminal simultaneously transmits the SR and other uplink control information in the target uplink control channel. For example, the P is less than or equal to $K \cdot T$, where $K > 0$, and K is a constant or configured by a base station, preferably, $K=1$. Preferably, the SR and the other uplink control information are joint coded and then mapped into the target uplink control channel for transmission.

15 If the first preset relationship is not satisfied, the terminal transmits the other uplink control information by using the first set of time domain symbols in the target uplink control channel. Specifically, there are four methods of transmission.

Method A:

20 Acts on a terminal side: The terminal transmits the SR on the frequency domain resource corresponding to the SR. The first set of time domain symbols are time domain symbols other than time domain symbols used for actually transmitting the SR in all time domain symbols in the target uplink control channel, as shown in FIG. 5.

Acts on a base station side: The base station first detects whether there is the SR on the resource corresponding to the SR. If there is the SR, the target uplink control channel is not received on the corresponding time domain symbols. If there is no SR, the target uplink control channel is received on the corresponding time domain symbols.

25 Method B:

Acts on a terminal side: The terminal transmits the SR on the frequency domain resource corresponding to the SR. The first set of time domain symbols are time domain symbols other than a time domain resource of the SR in all time domain symbols in the target uplink control

channel, as shown in FIG. 6.

Acts on a base station side: The base station does not receive the first uplink control channel on the time domain symbols corresponding to the SR.

Method C:

5 Acts on a terminal side: The terminal transmits the SR on a frequency domain resource where the target uplink control channel is located. The first set of time domain symbols are time domain symbols other than a time domain resource used for actually transmitting the SR in all time domain symbols in the target uplink control channel, as shown in FIG. 7.

10 Acts on a base station side: The base station first detects whether there is the SR on a resource where the target uplink control channel is located. If there is the SR, the target uplink control channel is not received on the corresponding time domain symbols. If there is no SR, the target uplink control channel is received on the corresponding time domain symbols.

Method D:

15 Acts on a terminal side: The terminal transmits the SR on a frequency domain resource where the target uplink control channel is located. The first set of time domain symbols are time domain symbols other than a time domain resource of the SR in all time domain symbols in the target uplink control channel, as shown in FIG. 8.

Acts on a base station side: The base station does not receive the first uplink control channel on the time domain symbols corresponding to the SR.

20 In a preferred embodiment, the terminal judges whether a size of the frequency domain resource of the target uplink control channel is not less than a size of the frequency domain resource corresponding to the SR. If yes, the method C or method D is used, otherwise the method A or method B is used.

25 There are two transmission methods for the SR: one is of an on-off manner (applicable to the methods A, B, C and D), and the other is of a sequence selection manner (applicable only to the method D), as shown in FIG. 9.

In the on-off manner, when the SR is positive, the terminal uses a preset sequence for transmission, and when the SR is negative, the terminal does not transmit any information.

Corresponding acts on a base station side are: the base station first detects whether there is the SR on the resource corresponding to the SR. If there is the SR, the first uplink control channel is not received on the corresponding time domain symbols. If there is no SR, the first uplink control channel is received on the corresponding time domain symbols.

5 In the sequence selection manner (applicable only to the method D), when the SR is positive, the terminal transmits a first preset sequence, and when the SR is negative, the terminal transmits a second preset sequence. Corresponding acts on a base station side are: the base station does not receive the first uplink control channel on the time domain symbols corresponding to the SR.

10 In some embodiments of the present invention, it is mentioned that a certain physical quantity in a determination condition can take any value, which can be realized by setting this physical quantity equal to a wildcard in the determination condition. This is common in the field of the computer technology. For example, a convention character (wildcard) can be used to represent any character in a regular expression or SQL statement. In this case, the physical
15 quantity still exists in the expression of the determination condition, but it may not actually be a substantial restriction.

The method embodiments of the present invention may all be realized by software, hardware, and firmware, etc. No matter whether the present invention is realized by software, or hardware, or firmware, the instruction codes can be stored in any type of computer accessible
20 memory (such as permanent or modifiable, volatile or non-volatile, solid-state or non solid-state, fixed or replaceable medium, etc.). Similarly, the memory may be, for example, a programmable array logic (PAL), a random access memory (RAM), a programmable read only memory (PROM), a read-only memory (ROM), an electrically erasable programmable ROM (EEPROM), a floppy disc, an optical disc, a digital versatile disc (DVD), or the like.

25 It should be noted that units disclosed in each device embodiment of the present invention are logical units. Physically, a logic unit may be a physical unit, or may be part of a physical unit, or may be implemented in combination with several physical units. Physical implementation modes for these logic units themselves are not the most important, the combination of the functions achieved by these logic units is the key to solving the technical

problem disclosed in the present invention. Furthermore, in order to highlight an innovative part of the present invention, the above device embodiments of the present invention do not introduce the units which are not related closely to solving the technical problem disclosed in the present invention, and this does not indicate that the above device embodiments do not
5 include other units.

It should be noted that in the application document of the present invention, relationship terms, such as first, second, are just used for distinguishing one entity or operation from another entity or operation, instead of requiring or indicating any practical relation or sequence existing between these entities or operations. Moreover, the term “include”, “comprise” or any other
10 variant intends to cover a non-exclusive inclusion, thus a process, a method, an object or a device including a series of elements includes not only those elements, but also other elements not listed explicitly, or includes inherent elements of the process, method, object or device. In a case that there are no more restrictions, an element limited by the statement “includes a” does not exclude the case that the process, the method, the object or the device including the element
15 further includes another same element. In the application document of the present invention, if it is mentioned that an act is executed according to an element, it means that the act is executed according to at least that element, which includes two situations: the act is executed only according to that element, and the act is executed according to that element and other elements. The expression of “multiple” elements means including two or more elements.

20 All documents cited in the present application are hereby incorporated by reference as if each had been individually incorporated by reference. In addition, it should be understood that after reading the above teachings of the presents application, those skilled in the art can make various changes or modifications to the presents application, and these equivalent forms also fall into the protection scope claimed in the present application.

What is claim is:

1. An uplink control channel transmission method, comprising:

determining, by a terminal, a period and a physical resource for transmitting an uplink scheduling request;

5 determining, by the terminal, to use a target uplink control channel for transmitting other uplink control information; and

determining, by the terminal, a multiplexing transmission mode of the uplink scheduling request and the other uplink control information according to a relationship between the period and a transmission duration of the target uplink control channel.

10 2. The uplink control channel transmission method of claim 1, wherein determining, by the terminal, the multiplexing transmission mode of the uplink scheduling request and the other uplink control information according to the relationship between the period and the transmission duration of the target uplink control channel comprises:

15 determining, by the terminal, that a first preset relationship between the period and the transmission duration of the target uplink control channel is satisfied; and

determining, by the terminal, that the uplink scheduling request and the other uplink control information are transmitted by multiplexing through the target uplink control channel.

20 3. The uplink control channel transmission method of claim 2, wherein determining, by the terminal, that the uplink scheduling request and the other uplink control information are transmitted by multiplexing through the target uplink control channel comprises:

mapping a processed uplink scheduling request and the other uplink control information into the target uplink control channel for transmission after processing of the uplink scheduling request and the other uplink control information, wherein the processing comprises at least one of the following:

25 concatenation;

joint coding;

interleaving; and

modulation.

4. The uplink control channel transmission method of claim 2, wherein the first preset relationship comprises:

5 the transmission duration of the target uplink control channel is less than or equal to a product of K and the period of the uplink scheduling request, wherein $K > 0$; and/or

a size of a frequency domain resource of the target uplink control channel is less than a size of a frequency domain resource corresponding to the physical resource.

10 5. The uplink control channel transmission method of any one of claims 1-4, wherein determining, by the terminal, the multiplexing transmission mode of the uplink scheduling request and the other uplink control information according to the relationship between the period and the transmission duration of the target uplink control channel comprises:

determining, by the terminal, that a second preset relationship between the period and the transmission duration of the target uplink control channel is satisfied; and

15 determining, by the terminal, to use a first set of time symbols in the target uplink control channel for transmitting the other uplink control information.

6. The uplink control channel transmission method of claim 5, wherein the second preset relationship comprises:

the transmission duration of the target uplink control channel is greater than a product of S and the period of the uplink scheduling request, wherein $S > 0$; and/or

20 a size of a frequency domain resource of the target uplink control channel is greater than or equal to a size of a frequency domain resource corresponding to the physical resource.

7. The uplink control channel transmission method of claim 5, wherein the other uplink control information is mapped to the first set of time symbols for transmission after a number matching is performed according to a number of the first set of time symbols; or

25 the other uplink control information is mapped to the first set of time symbols for transmission by puncturing.

8. The uplink control channel transmission method of claim 1, wherein determining, by the terminal, the multiplexing transmission mode of the uplink scheduling request and the other

uplink control information according to the relationship between the period and the transmission duration of the target uplink control channel comprises:

determining, by the terminal, that the target uplink control channel is a long physical uplink control channel, and the period is less than or equal to a preset first threshold; and

5 determining, by the terminal, to use a second set of time symbols in the target uplink control channel for transmitting the uplink scheduling request.

9. The uplink control channel transmission method of claim 1, wherein determining, by the terminal, the multiplexing transmission mode of the uplink scheduling request and the other uplink control information according to the relationship between the period and the transmission duration of the target uplink control channel comprises:

determining, by the terminal, that the target uplink control channel is a short physical uplink control channel, and the period is less than or equal to a preset second threshold; and

determining, by the terminal, to use a second set of time symbols in the target uplink control channel for transmitting the uplink scheduling request.

10. The uplink control channel transmission method of claim 1, wherein determining, by the terminal, the multiplexing transmission mode of the uplink scheduling request and the other uplink control information according to the relationship between the period and the transmission duration of the target uplink control channel comprises:

20 determining, by the terminal, that the target uplink control channel is a physical uplink control channel of any length, and the period is less than or equal to a preset third threshold; and

determining, by the terminal, to use a second set of time symbols in the target uplink control channel for transmitting the uplink scheduling request.

11. The uplink control channel transmission method of claim 1, wherein determining, by the terminal, the multiplexing transmission mode of the uplink scheduling request and the other uplink control information according to the relationship between the period and the transmission duration of the target uplink control channel comprises:

determining, by the terminal, that the target uplink control channel carries feedback

response information, and the uplink control channel is a physical uplink control channel of any length, and the period is less than or equal to a preset fourth threshold; and

determining, by the terminal, to use a second set of time symbols in the target uplink control channel for transmitting the uplink scheduling request.

5 12. The uplink control channel transmission method of claim 1, wherein determining, by the terminal, the multiplexing transmission mode of the uplink scheduling request and the other uplink control information according to the relationship between the period and the transmission duration of the target uplink control channel comprises:

determining, by the terminal, that the period is less than or equal to a preset fifth threshold;

10 and

determining, by the terminal, to use a second set of time symbols in the target uplink control channel for transmitting the uplink scheduling request.

13. The uplink control channel transmission method of claim 5, wherein the terminal transmits the uplink scheduling request on the physical resource; wherein

15 the first set of time domain symbols contains time domain symbols other than time domain symbols used for actually transmitting the uplink scheduling request in all time domain symbols in the target uplink control channel.

14. The uplink control channel transmission method of claim 5, wherein the terminal transmits the uplink scheduling request on the physical resource; wherein

20 the first set of time domain symbols contains time domain symbols other than time domain symbols overlapping with the physical resource in all time domain symbols in the target uplink control channel.

15. The uplink control channel transmission method of claim 5, wherein the terminal transmits the uplink scheduling request on a second set of time symbols in a frequency domain resource where the target uplink control channel is located, and the second set of time symbols are the same as time symbols occupied by the physical resource.

25

16. The uplink control channel transmission method of claim 15, wherein the first set of time domain symbols contains time domain symbols other than the second set of time symbols

in all time domain symbols in the target uplink control channel.

17. The uplink control channel transmission method of claim 15, wherein the first set of time domain symbols contains time domain symbols other than time domain symbols overlapping with the physical resource in all time domain symbols in the target uplink control
5 channel.

18. An uplink control channel transmission method, comprising:

determining, by a base station, a period and a physical resource for receiving an uplink scheduling request;

determining, by the base station, to use a target uplink control channel for receiving other
10 uplink control information; and

determining, by the base station, a multiplexing transmission mode of the uplink scheduling request and the other uplink control information according to a relationship between the period and a transmission duration of the target uplink control channel.

19. The uplink control channel transmission method of claim 18, wherein determining, by
15 the base station, the multiplexing transmission mode of the uplink scheduling request and the other uplink control information according to the relationship between the period and the transmission duration of the target uplink control channel comprises:

determining, by the base station, that a first preset relationship between the period and the transmission duration of the target uplink control channel is satisfied; and

20 determining, by the base station, that the uplink scheduling request and the other uplink control information are transmitted by multiplexing through the target uplink control channel.

20. The uplink control channel transmission method of claim 19, wherein determining, by the base station, that the uplink scheduling request and the other uplink control information are transmitted by multiplexing through the target uplink control channel comprises:

25 performing a processing on a signal received from the target uplink control channel, wherein the processing comprises one of the following or any combination thereof:

de-concatenation, joint decoding, de-interleaving and demodulation.

21. The uplink control channel transmission method of claim 19, wherein the first preset

relationship comprises:

the transmission duration of the target uplink control channel is less than or equal to a product of K and the period of the uplink scheduling request, wherein $K > 0$; and/or

5 a size of a frequency domain resource of the target uplink control channel is less than a size of a frequency domain resource corresponding to the physical resource.

22. The uplink control channel transmission method of any one of claims 13-16, wherein determining, by the base station, the multiplexing transmission mode of the uplink scheduling request and the other uplink control information according to the relationship between the period and the transmission duration of the target uplink control channel comprises:

10 determining, by the base station, that a second preset relationship between the period and the transmission duration of the target uplink control channel is satisfied; and

determining, by the base station, to use a first set of time symbols in the target uplink control channel for receiving the other uplink control information.

15 23. The uplink control channel transmission method of claim 22, wherein the second preset relationship comprises:

the transmission duration of the target uplink control channel is greater than a product of S and the period of the uplink scheduling request, wherein $S > 0$; and/or

a size of a frequency domain resource of the target uplink control channel is greater than or equal to a size of a frequency domain resource corresponding to the physical resource.

20 24. The uplink control channel transmission method of claim 22, wherein the other uplink control information is mapped to the first set of time symbols for transmission after a number matching is performed according to a number of the first set of time symbols; or

the other uplink control information is mapped to the first set of time symbols for transmission by puncturing.

25 25. The uplink control channel transmission method of claim 18, wherein determining, by the base station, the multiplexing transmission mode of the uplink scheduling request and the other uplink control information according to the relationship between the period and the transmission duration of the target uplink control channel comprises:

determining, by the base station, that the target uplink control channel is a long physical uplink control channel, and the period is less than or equal to a preset first threshold; and

determining, by the base station, to use a second set of time symbols in the target uplink control channel for receiving the uplink scheduling request.

5 26. The uplink control channel transmission method of claim 18, wherein determining, by the base station, the multiplexing transmission mode of the uplink scheduling request and the other uplink control information according to the relationship between the period and the transmission duration of the target uplink control channel comprises:

10 determining, by the base station, that the target uplink control channel is a short physical uplink control channel, and the period is less than or equal to a preset second threshold; and

determining, by the base station, to use a second set of time symbols in the target uplink control channel for receiving the uplink scheduling request.

15 27. The uplink control channel transmission method of claim 18, wherein determining, by the base station, the multiplexing transmission mode of the uplink scheduling request and the other uplink control information according to the relationship between the period and the transmission duration of the target uplink control channel comprises:

determining, by the base station, that the target uplink control channel is a physical uplink control channel of any length, and the period is less than or equal to a preset third threshold; and

20 determining, by the base station, to use a second set of time symbols in the target uplink control channel for receiving the uplink scheduling request.

25 28. The uplink control channel transmission method of claim 18, wherein determining, by the base station, the multiplexing transmission mode of the uplink scheduling request and the other uplink control information according to the relationship between the period and the transmission duration of the target uplink control channel comprises:

determining, by the base station, that the target uplink control channel carries feedback response information, and that the uplink control channel is a physical uplink control channel of any length, and the period is less than or equal to a preset fourth threshold; and

determining, by the base station, to use a second set of time symbols in the target uplink control channel for receiving the uplink scheduling request.

29. The uplink control channel transmission method of claim 18, wherein determining, by the base station, the multiplexing transmission mode of the uplink scheduling request and the other uplink control information according to the relationship between the period and the transmission duration of the target uplink control channel comprises:

determining, by the base station, that the period is less than or equal to a preset fifth threshold; and

determining, by the base station, to use a second set of time symbols in the target uplink control channel for receiving the uplink scheduling request.

30. The uplink control channel transmission method of claim 22, wherein the base station receives the uplink scheduling request on the physical resource, and

the first set of time domain symbols contains time domain symbols other than time domain symbols used for actually transmitting the uplink scheduling request in all time domain symbols in the target uplink control channel.

31. The uplink control channel transmission method of claim 22, wherein the base station receives the uplink scheduling request on the physical resource, and

the first set of time domain symbols contains time domain symbols other than time domain symbols overlapping with the physical resource in all time domain symbols in the target uplink control channel.

32. The uplink control channel transmission method of claim 22, wherein the base station receives the uplink scheduling request on a second set of time symbols in a frequency domain resource where the target uplink control channel is located, and the second set of time symbols are the same as time symbols occupied by the physical resource.

33. The uplink control channel transmission method of claim 32, wherein the first set of time domain symbols contains time domain symbols other than the second set of time symbols in all time domain symbols in the target uplink control channel, or

the first set of time domain symbols contains time domain symbols other than time

domain symbols overlapping with the physical resource in all time domain symbols in the target uplink control channel.

34. A terminal, comprising:

5 a first module, configured to determine a period and a physical resource for transmitting an uplink scheduling request;

a second module, configured to determine to use a target uplink control channel for transmitting other uplink control information; and

10 a third module, configured to determine a multiplexing transmission mode of the uplink scheduling request and the other uplink control information according to a relationship between the period and a transmission duration of the target uplink control channel.

35. The terminal of claim 34, wherein the third module comprises:

a first sub-module, configured to determine that a first preset relationship between the period and the transmission duration of the target uplink control channel is satisfied; and

15 a second sub-module, configured to determine that the uplink scheduling request and the other uplink control information are transmitted by multiplexing through the target uplink control channel;

wherein the first preset relationship comprises:

the transmission duration of the target uplink control channel is less than or equal to a product of K and the period of the uplink scheduling request, wherein $K > 0$; and/or

20 a size of a frequency domain resource of the target uplink control channel is less than a size of a frequency domain resource corresponding to the physical resource.

36. The terminal of claim 34, wherein the third module comprises:

a third sub-module, configured to determine that a second preset relationship between the period and the transmission duration of the target uplink control channel is satisfied; and

25 a fourth sub-module, configured to determine to use a first set of time symbols in the target uplink control channel for transmitting the other uplink control information;

wherein the second preset relationship comprises:

the transmission duration of the target uplink control channel is greater than a product of S and the period of the uplink scheduling request, wherein $S > 0$; and/or

a size of a frequency domain resource of the target uplink control channel is greater than or equal to a size of a frequency domain resource corresponding to the physical resource.

5 37. The terminal of claim 34, wherein the third module comprises any one of following sub-modules:

10 a ninth sub-module, configured to determine to use a second set of time symbols in the target uplink control channel for transmitting the uplink scheduling request when it is determined that the target uplink control channel is a long physical uplink control channel and the period is less than or equal to a preset first threshold;

 a tenth sub-module, configured to determine to use a second set of time symbols in the target uplink control channel for transmitting the uplink scheduling request when it is determined that the target uplink control channel is a short physical uplink control channel and the period is less than or equal to a preset second threshold;

15 an eleventh sub-module, configured to determine to use a second set of time symbols in the target uplink control channel for transmitting the uplink scheduling request when it is determined that the target uplink control channel is a physical uplink control channel of any length and the period is less than or equal to a preset third threshold;

20 a twelfth sub-module, configured to determine to use a second set of time symbols in the target uplink control channel for transmitting the uplink scheduling request when it is determined that the target uplink control channel carries feedback response information, and the uplink control channel is a physical uplink control channel of any length, and the period is less than or equal to a preset fourth threshold; and

25 a thirteenth sub-module, configured to determine to use a second set of time symbols in the target uplink control channel for transmitting the uplink scheduling request when it is determined that the period is less than or equal to a preset fifth threshold.

 38. The terminal of claim 36 or 37, wherein the terminal transmits the uplink scheduling request on the physical resource, and the first set of time domain symbols contains time domain

symbols other than time domain symbols used for actually transmitting the uplink scheduling request in all time domain symbols in the target uplink control channel; or

the terminal transmits the uplink scheduling request on the physical resource, and the first set of time domain symbols contains time domain symbols other than time domain symbols
5 overlapping with the physical resource in all time domain symbols in the target uplink control channel; or

the terminal transmits the uplink scheduling request on a second set of time symbols in a frequency domain resource where the target uplink control channel is located, and the second set of time symbols are the same as time symbols occupied by the physical resource.

10 39. A base station, comprising:

a fourth module, configured to determine a period and a physical resource for receiving an uplink scheduling request;

a fifth module, configured to determine to use a target uplink control channel for receiving other uplink control information; and

15 a sixth module, configured to determine a multiplexing transmission mode of the uplink scheduling request and the other uplink control information according to a relationship between the period and a transmission duration of the target uplink control channel.

40. The base station of claim 39, wherein the sixth module comprises:

20 a fifth sub-module, configured to determine that a first preset relationship between the period and the transmission duration of the target uplink control channel is satisfied; and

a sixth sub-module, configured to determine that the uplink scheduling request and the other uplink control information are transmitted by multiplexing through the target uplink control channel;

wherein the first preset relationship comprises:

25 the transmission duration of the target uplink control channel is less than or equal to a product of K and the period of the uplink scheduling request, wherein $K > 0$; and/or

a size of a frequency domain resource of the target uplink control channel is less than a size of a frequency domain resource corresponding to the physical resource.

41. The base station of claim 39, wherein the sixth module comprises:

a seventh sub-module, configured to determine that a second preset relationship between the period and the transmission duration of the target uplink control channel is satisfied; and

5 an eighth sub-module, configured to determine to use a first set of time symbols in the target uplink control channel for receiving the other uplink control information;

wherein the second preset relationship comprises:

the transmission duration of the target uplink control channel is greater than a product of S and the period of the uplink scheduling request, wherein $S > 0$; and/or

10 a size of a frequency domain resource of the target uplink control channel is greater than or equal to a size of a frequency domain resource corresponding to the physical resource.

42. The base station of claim 39, wherein the sixth module comprises one of the following sub-modules:

15 a fourteenth sub-module, configured to determine to use a second set of time symbols in the target uplink control channel for receiving the uplink scheduling request when it is determined that the target uplink control channel is a long physical uplink control channel and the period is less than or equal to a preset first threshold;

20 a fifteenth sub-module, configured to determine to use a second set of time symbols in the target uplink control channel for receiving the uplink scheduling request when it is determined that the target uplink control channel is a short physical uplink control channel and the period is less than or equal to a preset second threshold;

a sixteenth sub-module, configured to determine to use a second set of time symbols in the target uplink control channel for receiving the uplink scheduling request when it is determined that the target uplink control channel is a physical uplink control channel of any length and the period is less than or equal to a preset third threshold;

25 a seventeenth sub-module, configured to determine to use a second set of time symbols in the target uplink control channel for receiving the uplink scheduling request when it is determined that the target uplink control channel carries feedback response information, and the uplink control channel is a physical uplink control channel of any length, and the period is less

than or equal to a preset fourth threshold; and

an eighteenth sub-module, configured to determine to use a second set of time symbols in the target uplink control channel for receiving the uplink scheduling request when it is determined that the period is less than or equal to a preset fifth threshold.

5 43. The base station of claim 41 or 42, wherein the base station receives the uplink scheduling request on the physical resource, and the first set of time domain symbols contains time domain symbols other than time domain symbols used for actually transmitting the uplink scheduling request in all time domain symbols in the target uplink control channel; or

10 the base station receives the uplink scheduling request on the physical resource, and the first set of time domain symbols contains time domain symbols other than time domain symbols overlapping with the physical resource in all time domain symbols in the target uplink control channel; or

15 the base station receives the uplink scheduling request on a second set of time symbols in a frequency domain resource where the target uplink control channel is located, and the second set of time symbols are the same as time symbols occupied by the physical resource.

41. An uplink control channel transmission method, comprising:

determining, by a terminal, a period and a physical resource for transmitting an uplink scheduling request;

20 determining, by the terminal, to use a target uplink control channel for transmitting other uplink control information; and

determining, by the terminal, to transmit the uplink scheduling request when it is determined that the period is less than or equal to a preset sixth threshold.

25 42. The uplink control channel transmission method of claim 41, wherein determining, by the terminal, to use the target uplink control channel for transmitting the other uplink control information comprises: determining, by the terminal, to use a first set of time symbols in the target uplink control channel for transmitting the other uplink control information; wherein

the terminal transmits the uplink scheduling request on the physical resource, and the first set of time domain symbols contains time domain symbols other than time domain symbols

used for actually transmitting the uplink scheduling request in all time domain symbols in the target uplink control channel; or

the terminal transmits the uplink scheduling request on the physical resource, and the first set of time domain symbols contains time domain symbols other than time domain symbols
5 overlapping with the physical resource in all time domain symbols in the target uplink control channel; or

the terminal transmits the uplink scheduling request on a second set of time symbols in a frequency domain resource where the target uplink control channel is located, and the second set of time symbols are the same as time symbols occupied by the physical resource.

10 43. An uplink control channel transmission method, comprising:

determining, by a base station, a period and a physical resource for receiving an uplink scheduling request;

determining, by the base station, to use a target uplink control channel for receiving other uplink control information; and

15 determining, by the base station, to receive the uplink scheduling request when it is determined that the period is less than or equal to a preset sixth threshold.

44. The uplink control channel transmission method of claim 43, wherein determining, by the base station, to use the target uplink control channel for receiving the other uplink control information comprises: determining, by the base station, to use a first set of time symbols in the
20 target uplink control channel for receiving the other uplink control information; wherein

the base station receives the uplink scheduling request on the physical resource, and the first set of time domain symbols contains time domain symbols other than time domain symbols used for actually transmitting the uplink scheduling request in all time domain symbols in the target uplink control channel; or

25 the base station receives the uplink scheduling request on the physical resource, and the first set of time domain symbols contains time domain symbols other than time domain symbols overlapping with the physical resource in all time domain symbols in the target uplink control channel; or

the base station receives the uplink scheduling request on a second set of time symbols in a frequency domain resource where the target uplink control channel is located, and the second set of time symbols are the same as time symbols occupied by the physical resource.

45. A terminal, comprising:

5 a ninth module, configured to determine a period and a physical resource for transmitting an uplink scheduling request;

a tenth module, configured to determine to use the target uplink control channel for transmitting other uplink control information; and

10 an eleventh module, configured to determine to transmit the uplink scheduling request when it is determined that the period is less than or equal to a preset sixth threshold.

46. The terminal of claim 45, wherein the tenth module determines to use a first set of time symbols in the target uplink control channel for transmitting the other uplink control information; wherein

15 the terminal transmits the uplink scheduling request on the physical resource, and the first set of time domain symbols contains time domain symbols other than time domain symbols used for actually transmitting the uplink scheduling request in all time domain symbols in the target uplink control channel; or the terminal transmits the uplink scheduling request on the physical resource, and the first set of time domain symbols contains time domain symbols other than time domain symbols overlapping with the physical resource in all time domain symbols in
20 the target uplink control channel; or the terminal transmits the uplink scheduling request on a second set of time symbols in a frequency domain resource where the target uplink control channel is located, and the second set of time symbols are the same as time symbols occupied by the physical resource.

47. A base station, comprising:

25 a twelfth module, configured to determine a period and a physical resource for receiving an uplink scheduling request;

a thirteenth module, configured to determine to use a target uplink control channel for receiving other uplink control information; and

a fourteenth module, configured to determine to receive the uplink scheduling request when it is determined that the period is less than or equal to a preset sixth threshold.

48. The base station of claim 47, wherein the thirteenth module determines to use a first set of time symbols in the target uplink control channel for receiving the other uplink control
5 information; wherein

the base station receives the uplink scheduling request on the physical resource, and the first set of time domain symbols contains time domain symbols other than time domain symbols used for actually transmitting the uplink scheduling request in all time domain symbols in the target uplink control channel; or the base station receives the uplink scheduling request on the
10 physical resource, and the first set of time domain symbols contains time domain symbols other than time domain symbols overlapping with the physical resource in all time domain symbols in the target uplink control channel; or the base station receives the uplink scheduling request on a second set of time symbols in a frequency domain resource where the target uplink control channel is located, and the second set of time symbols are the same as time symbols occupied
15 by the physical resource.

49. A terminal, comprising:

a memory, configured to store computer-executable instructions; and

a processor, configured to implement acts of the uplink control channel transmission method of any one of claims 1 to 17, 41 and 42 when the computer-executable instructions are
20 executed.

50. A base station, comprising:

a memory, configured to store computer-executable instructions; and

a processor, configured to implement acts of the uplink control channel transmission method of any one of claims 18 to 33, 43 and 44 when the computer-executable instructions are
25 executed.

51. A computer-readable storage medium, wherein computer-executable instructions are stored in the computer-readable storage medium, and the computer-executable instructions, when executed by a processor, implement the acts of the uplink control channel transmission

method of any one of claims 1-33 and 41-44.