WHAT IS CLAIMED IS:

1. A frequency hopping method, performed by a user equipment (UE), comprising:

obtaining an instruction configured by a base station for instructing to perform intra-slot frequency hopping;

obtaining symbol resources allocated by the base station for data transmission in a special slot;

performing intra-slot frequency hopping on an uplink slot and determining available symbols in the special slot; and

performing intra-slot frequency hopping on the available symbols in the symbol resources, or not performing intra-slot frequency hopping on the special slot.

2. The method according to claim 1, wherein determining the available symbols in the special slot comprises:

determining unavailable symbols in the special slot according to a slot format indication (SFI) dynamic indication signaling and/or a semi-static slot format configuration signaling; and

determining that the available symbols are symbols in the special slot other than the unavailable symbols;

wherein the unavailable symbols comprise at least one of:

a guard symbol for downlink to uplink switching;

a downlink symbol for downlink transmission;

a symbol for synchronization signal block (SSB) transmission;

a symbol allocated for a common search space (CSS);

a symbol occupied by a cancel indication (CI); or

a symbol for service transmission with a higher priority than current data transmission.

3. The method according to claim 2, wherein not performing intra-slot frequency hopping on the special slot comprises:

in response to a number of the available symbols in the symbol resources is less than or equal to a first threshold, determining not performing intra-slot frequency hopping on the special slot, the first threshold for indicating a minimum number of symbols in one hop when

intra-slot frequency hopping is performed on the special slot and the first threshold being indicated by the base station or determined by a protocol.

4. The method according to claim 2, wherein not performing intra-slot frequency hopping on the special slot comprises:

determining a time-domain position range of each hop in the special slot using a position of a first symbol in the symbol resources as a start position;

in response to a number of available symbols in the determined time-domain position range of a first hop is less than a second threshold, determining not performing intra-slot frequency hopping on the special slot; and

in response to the number of available symbols in the determined time-domain position range of the first hop is not less than the second threshold, performing intra-slot frequency hopping according to the time-domain position range of each hop in the special slot determined using the position of the first symbol in the symbol resources as the start position;

wherein the second threshold is indicated by the base station or determined by a protocol.

5. The method according to claim 2, wherein not performing intra-slot frequency hopping on the special slot comprises:

determining a time-domain position range of each hop in the special slot using a position of a first symbol in the symbol resources as a start position;

in response to a difference between a number of available symbols in the determined time-domain position range of a first hop and a number of available symbols in the determined time-domain position range of a second hop is greater than a third threshold, determining not performing intra-slot frequency hopping on the special slot; and

in response to the difference between the number of available symbols in the determined time-domain position range of the first hop and the number of available symbols in the determined time-domain position range of the second hop is not greater than the third threshold, performing intra-slot frequency hopping according to the time-domain position range of each hop in the special slot determined using the position of the first symbol in the symbol resources as the start position;

wherein the third threshold is indicated by the base station or determined by a protocol.

6. The method according to claim 2, wherein not performing intra-slot frequency hopping on the special slot comprises:

obtaining the instruction for instructing to perform intra-slot frequency hopping; and

determining not performing intra-slot frequency hopping on the special slot.

7. The method according to claim 2, after not performing intra-slot frequency hopping on the special slot, further comprising:

determining at least one first demodulation reference signal (DMRS) symbol offset value according to a parameter configured and/or indicated by the base station; and

determining a time-domain position of a DMRS in the special slot according to a first available symbol in the symbol resources allocated by the base station and the at least one first DMRS symbol offset value.

8. The method according to claim 7, wherein determining the time-domain position of the DMRS in the special slot according to the first available symbol in the symbol resources allocated by the base station and the at least one first DMRS symbol offset value comprises:

determining a sum of a symbol number of the first available symbol and each first DMRS symbol offset value to obtain at least one first sum value; and

determining that the time-domain position of the DMRS is a symbol with a symbol number corresponding to the first sum value.

9. The method according to claim 7, wherein the parameter comprises at least one of:

a physical uplink shared channel (PUSCH) mapping type, wherein the PUSCH mapping type comprises type A and type B;

a symbol length for data transmission in the special slot;

a start symbol position for data transmission in the special slot;

a DMRS-additional position;

a number of DMRS ports;

whether to enable intra-slot frequency hopping; or

a DMRS-type A position.

10. The method according to any one of claims 3-9, wherein a frequency-domain position of the special slot is the same as a frequency-domain position of any hop in the uplink slot.

11. The method according to claim 10, wherein the frequency-domain position of the special slot is the same as a frequency-domain position of a second hop in the uplink slot.

12. The method according to claim 2, wherein performing intra-slot frequency hopping on the available symbols in the symbol resources comprises:

in response to a number of the available symbols in the symbol resources is greater than a first threshold, performing intra-slot frequency hopping on the available symbols in the symbol resources, the first threshold for indicating a minimum number of symbols in one hop when intra-slot frequency hopping is performed on the special slot and the first threshold being indicated by the base station or determined by a protocol.

13. The method according to claim 2, wherein performing intra-slot frequency hopping on the available symbols in the symbol resources comprises:

determining a time-domain position range of each hop in the special slot using a position of a first symbol in the symbol resources as a start position;

in response to a number of available symbols in the determined time-domain position range of a first hop is less than a second threshold, performing intra-slot frequency hopping on the available symbols in the symbol resources; and

in response to the number of available symbols in the determined time-domain position range of the first hop is not less than the second threshold, performing intra-slot frequency hopping according to the time-domain position range of each hop in the special slot determined using the position of the first symbol in the symbol resources as the start position;

wherein the second threshold is indicated by the base station or determined by a protocol.

14. The method according to claim 2, wherein performing intra-slot frequency hopping on the available symbols in the symbol resources comprises:

determining a time-domain position range of each hop in the special slot using a position

of a first symbol in the symbol resources as a start position;

in response to a difference between a number of available symbols in the determined time-domain position range of a first hop and a number of available symbols in the determined time-domain position range of a second hop is greater than a third threshold, performing intra-slot frequency hopping on the available symbols in the symbol resources; and

in response to the difference between the number of available symbols in the determined time-domain position range of the first hop and the number of available symbols in the determined time-domain position range of the second hop is not greater than the third threshold, performing intra-slot frequency hopping according to the time-domain position range of each hop in the special slot determined using the position of the first symbol in the symbol resources as the start position;

wherein the third threshold is indicated by the base station or determined by a protocol.

15. The method according to claim 2, wherein performing intra-slot frequency hopping on the available symbols in the symbol resources comprises:

after obtaining the instruction for instructing to perform intra-slot frequency hopping, performing intra-slot frequency hopping on the available symbols in the symbol resources.

16. The method according to any one of claims 12-15, wherein performing intra-slot frequency hopping on the available symbols in the symbol resources comprises:

determining a time-domain start position of a first hop in the special slot is: a position of a first available symbol in the symbol resources;

determining a time-domain end position of the first hop is: the position of the first available symbol in the symbol resources + floor (a number of the available symbols in the symbol resources ÷ 2) -1; wherein a floor function is a downward rounding function;

determining a time-domain start position of a second hop in the special slot is: the position of the first available symbol in the symbol resources + floor (the number of the available symbols in the symbol resources ÷ 2); and

determining a time-domain end position of the second hop is: the position of the first available symbol in the symbol resources + floor (the number of the available symbols in the symbol resources ÷2) + the number of the available symbols in the symbol resources – floor

(the number of the available symbols in the symbol resources ÷ 2) - 1.

17. The method according to claim 16, after performing intra-slot frequency hopping on the available symbols in the symbol resources, further comprising:

determining a time-domain position of a DMRS in each hop according to a parameter configured and/or indicated by the base station, a number of symbols in a time-domain position range of each hop, and a start symbol of each hop.

18. The method according to claim 17, wherein determining the time-domain position of the DMRS in each hop comprises:

determining at least one second DMRS symbol offset value according to the parameter configured and/or indicated by the base station and a number of symbols in a time-domain position range of a second hop;

determining a sum of a symbol number of a start symbol of the second hop and each second DMRS symbol offset value to obtain at least one second sum value,

determining that the time-domain position of the DMRS in the second hop is a symbol with a symbol number corresponding to the second sum value;

determining a sum of a symbol number of a start symbol of a first hop and each second DMRS symbol offset value to obtain at least one third sum value; and

determining that the time-domain position of the DMRS in the first hop is a symbol with a symbol number corresponding to the third sum value.

19. The method according to claim 17, wherein determining the time-domain position of the DMRS in each hop comprises:

determining at least one second DMRS symbol offset value according to the parameter configured and/or indicated by the base station and a number of symbols in a time-domain position range of a second hop;

determining a sum of a symbol number of a start symbol of the second hop and each second DMRS symbol offset value to obtain at least one second sum value,

determining that the time-domain position of the DMRS in the second hop is a symbol with a symbol number corresponding to the second sum value;

determining at least one third DMRS symbol offset value according to the parameter configured and/or indicated by the base station and a number of symbols in a time-domain position range of a first hop;

determining a sum of a symbol number of a start symbol of the first hop and each third DMRS symbol offset value to obtain at least one third sum value; and

determining that the time-domain position of the DMRS in the first hop is a symbol with a symbol number corresponding to the third sum value.

20. The method according to claim 17, wherein the parameter comprises at least one of:

a physical uplink shared channel (PUSCH) mapping type, wherein the PUSCH mapping type comprises type A and type B;

a symbol length for data transmission in the special slot;

a start symbol position for data transmission in the special slot;

a DMRS-additional position;

a number of DMRS ports; or

a DMRS-type A position.

21. The method according to claim 20, wherein determining the time-domain position of the DMRS in each hop according to the parameter configured and/or indicated by the base station, the number of symbols in the time-domain position range of each hop, and the start symbol of each hop, comprises:

in response to the PUSCH mapping type in the parameter is type A, according to a mapping rule of type A, determining the time-domain position of the DMRS in each hop according to the parameter configured and/or indicated by the base station, the number of symbols in the time-domain position range of each hop, and the start symbol of each hop; and

in response to the PUSCH mapping type in the parameter is type B, according to a mapping rule of type B, determining the time-domain position of the DMRS in each hop according to the parameter configured and/or indicated by the base station, the number of symbols in the time-domain position range of each hop, and the start symbol of each hop.

22. A frequency hopping method, performed by a base station, comprising:

determining to perform intra-slot frequency hopping, and configuring an instruction for instructing to perform intra-slot frequency hopping to a user equipment (UE);

determining a parameter, and determining symbol resources for data transmission in a special slot according to the parameter;

performing intra-slot frequency hopping on an uplink slot, and determining available symbols in the special slot; and

performing intra-slot frequency hopping on the available symbols in the symbol resources, or not performing intra-slot frequency hopping on the special slot.

23. The method according to claim 22, wherein determining the available symbols in the special slot comprises:

determining unavailable symbol(s) in the special slot; and

determining that the available symbols are symbols in the special slot other than the unavailable symbol(s);

wherein the unavailable symbol(s) comprise at least one of:

a guard symbol for downlink to uplink switching;

a downlink symbol for downlink transmission;

a symbol for synchronization signal block (SSB) transmission;

a symbol allocated for a common search space (CSS);

a symbol occupied by a cancel indication (CI); or

a symbol for service transmission with a higher priority than current data transmission.

24. The method according to claim 23, wherein not performing intra-slot frequency hopping on the special slot comprises:

in response to a number of the available symbols in the symbol resources is less than or equal to a first threshold, determining not performing intra-slot frequency hopping on the special slot, the first threshold for indicating a minimum number of symbols in one hop when intra-slot frequency hopping is performed on the special slot and the first threshold being determined by the base station or by a protocol.

25. The method according to claim 23, wherein not performing intra-slot frequency

hopping on the special slot comprises:

determining a time-domain position range of each hop in the special slot using a position of a first symbol in the symbol resources as a start position according to the symbol resources;

in response to a number of available symbols in the determined time-domain position range of a first hop is less than a second threshold, determining not performing intra-slot frequency hopping on the special slot; and

in response to the number of available symbols in the determined time-domain position range of the first hop is not less than the second threshold, performing intra-slot frequency hopping according to the time-domain position range of each hop in the special slot determined using the position of the first symbol in the symbol resources as the start position;

wherein the second threshold is determined by the base station or by a protocol.

26. The method according to claim 23, wherein not performing intra-slot frequency hopping on the special slot comprises:

determining a time-domain position range of each hop in the special slot using a position of a first symbol in the symbol resources as a start position according to the symbol resources;

in response to a difference between a number of available symbols in the determined time-domain position range of a first hop and a number of available symbols in the determined time-domain position range of a second hop is greater than a third threshold, determining not performing intra-slot frequency hopping on the special slot; and

in response to the difference between the number of available symbols in the determined time-domain position range of the first hop and the number of available symbols in the determined time-domain position range of the second hop is not greater than the third threshold, performing intra-slot frequency hopping according to the time-domain position range of each hop in the special slot determined using the position of the first symbol in the symbol resources as the start position;

wherein the third threshold is determined by the base station or by a protocol.

27. The method according to claim 23, wherein not performing intra-slot frequency hopping on the special slot comprises:

determining to perform intra-slot frequency hopping; and

determining to not perform intra-slot frequency hopping on the special slot.

28. The method according to claim 23, after not performing intra-slot frequency hopping on the special slot, further comprising:

determining at least one first demodulation reference signal (DMRS) symbol offset value according to the parameter; and

determining a time-domain position of a DMRS in the special slot according to a first available symbol in the symbol resources allocated by the base station and the at least one first DMRS symbol offset value.

29. The method according to claim 28, wherein determining the time-domain position of the DMRS in the special slot according to the first available symbol in the symbol resources allocated by the base station and the at least one first DMRS symbol offset value comprises:

determining a sum of a symbol number of the first available symbol and each first DMRS symbol offset value to obtain at least one first sum value; and

determining that the time-domain position of the DMRS is a symbol with a symbol number corresponding to the first sum value.

30. The method of claim 28, wherein the parameter comprises at least one of:

a physical uplink shared channel (PUSCH) mapping type, wherein the PUSCH mapping type comprises type A and type B;

a symbol length for data transmission in the special slot;

a start symbol position for data transmission in the special slot;

a DMRS-additional position;

a number of DMRS ports; or

a DMRS-type A position.

31. The method according to any one of claims 22-30, wherein a frequency-domain position of the special slot is the same as a frequency-domain position of any hop in the uplink slot.

32. The method according to claim 31, wherein the frequency-domain position of the special slot is the same as a frequency-domain position of a second hop in the uplink slot.

33. The method according to claim 23, wherein performing intra-slot frequency hopping on the available symbols in the symbol resources comprises:

in response to a number of the available symbols in the symbol resources is greater than a first threshold, performing intra-slot frequency hopping on the available symbols in the symbol resources, the first threshold for indicating a minimum number of symbols in one hop when intra-slot frequency hopping is performed on the special slot and the first threshold being determined by the base station or by a protocol.

34. The method according to claim 23, wherein performing intra-slot frequency hopping on the available symbols in the symbol resources comprises:

determining a time-domain position range of each hop in the special slot using a position of a first symbol in the symbol resources as a start position according to the symbol resources;

in response to a number of available symbols in the determined time-domain position range of a first hop is less than a second threshold, performing intra-slot frequency hopping on the available symbols in the symbol resources; and

in response to the number of available symbols in the determined time-domain position range of the first hop is not less than the second threshold, performing intra-slot frequency hopping according to the time-domain position range of each hop in the special slot determined using the position of the first symbol in the symbol resources as the start position;

wherein the second threshold is determined by the base station or by a protocol.

35. The method according to claim 23, wherein performing intra-slot frequency hopping on the available symbols in the symbol resources comprises:

determining a time-domain position range of each hop in the special slot using a position of a first symbol in the symbol resources as a start position according to the symbol resources;

in response to a difference between a number of available symbols in the determined time-domain position range of a first hop and a number of available symbols in the determined time-domain position range of a second hop is greater than a third threshold, performing intra-slot

frequency hopping on the available symbols in the symbol resources; and

in response to the difference between the number of available symbols in the determined time-domain position range of the first hop and the number of available symbols in the determined time-domain position range of the second hop is not greater than the third threshold, performing intra-slot frequency hopping according to the time-domain position range of each hop in the special slot determined using the position of the first symbol in the symbol resources as the start position;

wherein the third threshold is determined by the base station or by a protocol.

36. The method according to claim 23, wherein performing intra-slot frequency hopping on the available symbols in the symbol resources comprises:

after obtaining the instruction for instructing to perform intra-slot frequency hopping, performing intra-slot frequency hopping on the available symbols in the symbol resources.

37. The method according to any one of claims 33-36, wherein performing intra-slot frequency hopping on the available symbols in the symbol resources comprises:

determining a time-domain start position of a first hop in the special slot is: a position of a first available symbol in the symbol resources; and determining a time-domain end position of the first hop is: the position of the first available symbol in the symbol resources + floor (a number of the available symbols in the symbol resources ÷ 2) -1; wherein a floor function is a downward rounding function; and

determining a time-domain start position of a second hop in the special slot is: the position of the first available symbol in the symbol resources + floor (the number of the available symbols in the symbol resources ÷ 2); and determining a time-domain end position of the second hop is: the position of the first available symbol in the symbol resources + floor (the number of the available symbols in the symbol resources ÷2) + the number of the available symbols in the symbol resources – floor (the number of the available symbols in the symbol resources ÷ 2) - 1.

38. The method according to claim 37, after performing intra-slot frequency hopping on the available symbols in the symbol resources, further comprising:

determining a time-domain position of a DMRS in each hop according to the parameter, a number of symbols in a time-domain position range of each hop, and a start symbol of each hop.

39. The method according to claim 38, wherein determining the time-domain position of the DMRS in each hop comprises:

determining at least one second DMRS symbol offset value according to the parameter and a number of symbols in a time-domain position range of a second hop;

determining a sum of a symbol number of a start symbol of the second hop and each second DMRS symbol offset value to obtain at least one second sum value, and determining that the time-domain position of the DMRS in the second hop is a symbol with a symbol number corresponding to the second sum value; and

determining a sum of a symbol number of a start symbol of a first hop and each second DMRS symbol offset value to obtain at least one third sum value, and determining that the time-domain position of the DMRS in the first hop is a symbol with a symbol number corresponding to the third sum value.

40. The method according to claim 38, wherein determining the time-domain position of the DMRS in each hop comprises:

determining at least one second DMRS symbol offset value according to the parameter and a number of symbols a time-domain position range of a second hop;

determining a sum of a symbol number of a start symbol of the second hop and each second DMRS symbol offset value to obtain at least one second sum value, and determining that the time-domain position of the DMRS in the second hop is a symbol with a symbol number corresponding to the second sum value;

determining at least one third DMRS symbol offset value according to the parameter and a number of symbols in a time-domain position range of a first hop; and

determining a sum of a symbol number of a start symbol of the first hop and each third DMRS symbol offset value to obtain at least one third sum value, and determining that the time-domain position of the DMRS in the first hop is a symbol with a symbol number corresponding to the third sum value.

41. The method of claim 38, wherein the parameter comprises at least one of:

a physical uplink shared channel (PUSCH) mapping type, wherein the PUSCH mapping type comprises type A and type B;

a symbol length for data transmission in the special slot;

a DMRS-additional position;

a number of DMRS ports; or

a DMRS-type A position.

42. The method according to claim 41, wherein determining the time-domain position of the DMRS in each hop according to the parameter, the number of symbols in the time-domain position range of each hop, and the start symbol of each hop, comprises:

in response to the PUSCH mapping type in the parameter is type A, according to a mapping rule of type A, determining the time-domain position of the DMRS in each hop according to the parameter, the number of symbols in the time-domain position range of each hop, and the start symbol of each hop; and

in response to the PUSCH mapping type in the parameter is type B, according to a mapping rule of type B, determining the time-domain position of the DMRS in each hop according to the parameter, the number of symbols in the time-domain position range of each hop, and the start symbol of each hop.

43. The method according to claim 28 or 38, further comprising:

configuring and/or indicating the parameter to the UE.

44. The method according to claim 22, further comprising:

sending a slot format indication (SFI) dynamic indication signaling and/or a semi-static slot format configuration signaling to the UE.

45. A frequency hopping apparatus, comprising:

a transceiver module, configured to obtain an instruction configured by a base station for instructing to perform intra-slot frequency hopping and obtain symbol resources allocated by the base station for data transmission in a special slot; and

a processing module, configured to perform intra-slot frequency hopping on an uplink slot and determine available symbols in the special slot; and perform intra-slot frequency hopping on the available symbols in the symbol resources or not perform intra-slot frequency hopping on the special slot.

46. A frequency hopping apparatus, comprising:

a processing module, configured to determine to perform intra-slot frequency hopping, configure an instruction for instructing to perform intra-slot frequency hopping to a user equipment (UE), determine a parameter, and determine symbol resources for data transmission in a special slot according to the parameter;

wherein the processing module is further configured to perform intra-slot frequency hopping on an uplink slot and determine available symbols in the special slot; and perform intra-slot frequency hopping on the available symbols in the symbol resources or not perform intra-slot frequency hopping on the special slot.

47. A communication device comprising a processor and a memory, wherein a computer program is stored in the memory and the processor executes the computer program stored in the memory, so that the device performs the method as claimed in any one of claims 1 to 21.

48. A communication device comprising a processor and a memory, wherein a computer program is stored in the memory and the processor executes the computer program stored in the memory, so that the device performs the method as claimed in any one of claims 22 to 44.

49. A communication device, comprising a processor and an interface circuit;

the interface circuit for receiving code instructions and transmitting the code instructions to the processor;

the processor for executing the code instructions to perform the method as claimed in any one of claims 1 to 21.

50. A communication device, comprising a processor and an interface circuit;

the interface circuit for receiving code instructions and transmitting the code instructions

to the processor;

the processor for executing the code instructions to perform the method as claimed in any one of claims 22 to 44.

51. A computer-readable storage medium storing instructions that, when executed, cause the method of any of claims 1 to 21 to be performed.

52. A computer-readable storage medium storing instructions that, when executed, cause the method of any of claims 22 to 44 to be performed.