CLAIMS

1. An information transmission method, comprising:

placing a first Reference Signal (RS) symbol at beginning of a Physical Uplink Control Channel (PUCCH);

placing Uplink Control Information (UCI) symbols after the first RS symbol in the PUCCH; and

transmitting the PUCCH.

2. The method according to claim 1, wherein the transmitting the PUCCH comprises one of the following:

transmitting the PUCCH in one or more slots of a first type, wherein all symbols in each of the slots of the first type are uplink, which are dedicated for transmitting the PUCCH;

transmitting the PUCCH in one or more slots of a second type, wherein more than one half of symbols in each of the slots of the second type are uplink, which are dedicated for transmitting the PUCCH; and

transmitting the PUCCH in multiple slots comprising one or more slots of the first type and one or more slots of the second type, and

wherein the placing a first RS symbol at beginning of a PUCCH comprises:

placing the first RS symbol at the beginning of the PUCCH, in each of the slots of the first or second type.

3. The method according to claims 2, further comprising:

placing one or two RS symbols immediately after every n contiguous UCI symbols, in each of the slots of the first or second type, until a last symbol in the slot is filled by an RS or UCI symbol, wherein n is an integer greater than or equal to 1.

4. The method according to any of claims 1 to 3, further comprising: before transmitting the PUCCH, performing Space-Time Block Coding (STBC) on at least a portion of the UCI symbols in the PUCCH to build STBC codes.

5. The method according to claim 4, further comprising:

generating an orthogonal sequence for each of modulated symbols carrying UCI in the PUCCH, wherein the UCI symbols comprise m UCI symbols in time, where m is an integer, and greater than or equal to 2,

wherein the performing STBC on at least a portion of UCI symbols comprises: for $(2k\text{-}1)^{th}$ and $(2k)^{th}$ UCI symbols in time,

directly using the elements of the orthogonal sequences corresponding to the $(2k\text{-}1)^{th}$ and $(2k)^{th}$ UCI symbols to build a first set of pairs of STBC codes, and

performing conjugation transformation on the elements of the generated orthogonal sequences corresponding to the $(2k\text{-}1)^{th}$ and $(2k)^{th}$ UCI symbols to build a second set of pairs of STBC codes;

wherein the transmitting the PUCCH comprises:

transmitting the PUCCH with the first set of pairs of STBC codes via a first antenna; and

transmitting the PUCCH with the second set of pairs of STBC codes via a second antenna,

where k is a positive integer and smaller than or equal to $m/2$.

6. The method according to any of claims 1 to 5, wherein the transmitting the PUCCH further comprises:

transmitting a first portion of the PUCCH in a first frequency band; and

transmitting a second portion of the PUCCH in a second frequency band.

7. The method according to claim 6, wherein the PUCCH transmitted in a single one of the first or second slots is divided into the first portion and the second portion.

8. The method according to claim 6, wherein the second portion of the PUCCH begins with an RS symbol.

9. An information transmission apparatus, comprising:

a processor, configured to place a first RS symbol at beginning of a Physical Uplink Control Channel (PUCCH), and place UCI symbols after the first RS symbol in the PUCCH; and

a transmitter, configured to transmit the PUCCH.

10. The apparatus according to claim 9, wherein the transmitter is configured to perform one of the following:

transmit the PUCCH in one or more slots of a first type, wherein all symbols in each of the slots of the first type are uplink, which are dedicated for transmitting the PUCCH;

transmit the PUCCH in one or more slots of a second type, wherein more than one half of symbols in each of the slots of the second type are uplink, which are dedicated for transmitting the PUCCH; and

transmit the PUCCH in multiple slots comprising one or more slots of the first type and one or more slots of the second type, and

wherein the RS processor is configured to place the first RS symbol at the beginning of the PUCCH, in each of the slots of the first or second type.

11. The apparatus according to claim 10, wherein the processor is further configured to place one or two RS symbols immediately after every n contiguous UCI symbols, in each of the slots of the first or second type, until a last symbol in the slot is filled by an RS or UCI symbol, wherein n is an integer greater than or equal to 1.

12. The apparatus according to any of claims 9 to 11, wherein the information transmission apparatus further comprise:

a transmit diversity module, configured to perform Space-Time Block Coding (STBC) on at least a portion of the UCI symbols in the PUCCH to build STBC codes.

13. The apparatus according to claim 12, wherein the information transmission apparatus further comprise:

a sequence generation module configured to generate an orthogonal sequence for each of modulated symbols carrying UCI in the PUCCH, wherein the UCI symbols comprise m UCI symbols in time, where m is an integer, and greater than or equal to 2;

wherein the transmit diversity module is configured to: for $(2k\text{-}1)^{th}$ and $(2k)^{th}$ UCI symbols in time,

directly use elements of the orthogonal sequences corresponding to the $(2k\text{-}1)^{th}$ and $(2k)^{th}$ UCI symbols to build a first set of pairs of STBC codes, and

perform conjugation transformation on the elements of the generated orthogonal sequences corresponding to the $(2k\text{-}1)^{th}$ and $(2k)^{th}$ UCI symbols to build a second set of pairs of STBC codes;

wherein the transmitter is configured to:

transmit the PUCCH with the first set of pairs of STBC codes via a first antenna; and

transmit the PUCCH with the second set of pairs of STBC codes via a second antenna,

where k is a positive integer and smaller than or equal to $m/2$.

14. The apparatus according to any of claims 9 to 13, wherein the transmitter is further configured to:

transmit a first portion of the PUCCH in a first frequency band; and

transmit a second portion of the PUCCH in a second frequency band.

15. The apparatus according to claim 14, wherein the PUCCH transmitted in a single one of the first or second slots is divided into the first portion and the second portion.

16. The apparatus according to claim 14, wherein the second portion of the PUCCH begins with an RS symbol.