

CLAIMS

WHAT IS CLAIMED IS:

1. A method of wireless communications, comprising:
determining, at a base station, a ~~distance between a first user equipment (UE) and a second UE of a plurality of UEs, wherein the distance is determined based on one or more of a sequence length, a number of hypothesis, or a number of UEs sharing an orthogonal frequency division multiplexing (OFDM) symbol;~~
~~determining, at the base station, a plurality of cyclic shifts for each of the first UE and the second UE, wherein the plurality of cyclic shifts are determined relative to a base sequence and based on the~~separated by a hypothesis distance, wherein the hypothesis distance is based on a number of hypotheses, wherein the hypothesis distance and the number of UEs sharing the
~~OFDM~~is a distance between a first hypothesis and a second hypothesis associated with a first UE and a second UE for an orthogonal frequency division multiplexing (OFDM) symbol;
assigning one or more sequences to each of the first UE and the second UE, wherein the one or more sequences assigned to the first UE and the second UE are based on a corresponding plurality of cyclic shifts associated with the first UE and the second UE; and
receiving, at the base station, a multiplexed signal, wherein the multiplexed signal includes at least one bit of uplink control information (UCI) from the first UE and the second UE multiplexed on an uplink short burst transmitted via the OFDM symbol.
2. The method of claim 1, wherein the ~~distance is a hypothesis distance, a user distance, or a random distance, and wherein the~~ at least one bit of UCI includes one or more bits of an acknowledgement (ACKs), negative ACK (NACK) or a scheduling request (SR).
3. ~~The method of claim 2, wherein the distance is the hypothesis distance, and wherein the hypothesis distance is a distance between a first hypothesis and a second hypothesis associated with a UE, and wherein the UE is the first UE or the second UE.~~
4. ~~The method of claim 3, wherein the hypothesis distance is a maximum hypothesis distance.~~
5. ~~The method of claim 3, wherein the first hypothesis is an ACK and the second hypothesis is a NACK.~~
6. ~~The method of claim 2, wherein the distance is the user distance, and wherein the user distance is a distance between the first UE and a second UE.~~

~~7. The method of claim 6, wherein the user distance is a maximum user distance.~~

~~8. The method of claim 2, wherein the distance is based on random assigning of sequences to the first UE and the second UE.~~

4. The method of claim 1, wherein the hypothesis distance is a maximum hypothesis distance.

5. The method of claim 1, wherein the first hypothesis is an ACK and the second hypothesis is a NACK.

96. The method of claim 1, wherein the at least one bit of UCI comprises at least one scheduling request (SR) bit, at least one acknowledgement (ACK) bit, or at least one SR bit and at least one ACK bit.

~~107.~~ The method of claim 96, wherein the hypothesis distance between two of the plurality of cyclic shifts is 6 for 2 UCI hypothesis from one UE.

~~118.~~ The method of claim 96, wherein the minimum hypothesis distance between any two adjacent cyclic shifts of the plurality of cyclic shifts is 3 for 4 UCI hypothesis from one UE.

~~129.~~ The method of claim 96, wherein receiving the multiplexed signal includes receiving the at least one SR bit and the at least one ACK bit in a short physical uplink control channel (PUCCH) for the at least one bit of UCI of up to 2 bits.

~~13-10.~~ The method of claim 96, wherein the at least one bit of UCI comprises at most one scheduling request (SR) bit, at most two acknowledgement (ACK) bits, or at most one SR bit and at most two ACK bits.

~~14-11.~~ The method of claim 1, wherein the sequence has a length of 12 indices.

~~15-12.~~ The method of claim 1, wherein one cyclic shift includes only a single scheduling request (SR).

~~16-13.~~ The method of claim 1, wherein the multiplexed signal includes UCI from both the first UE and the second UE.

~~17-14.~~ A method of wireless communications, comprising:

determining, at a base station, ~~comprising:~~ a distance between a first user equipment (UE) and a second UE of a plurality of UEs, wherein the distance is determined based on one or more of a sequence length, a number of hypothesis, or a number of UEs sharing an orthogonal frequency division multiplexing (OFDM) symbol;

a memory; and

a processor in communication with the memory and configured to:

~~determined~~determining, at the base station, a plurality of cyclic shifts for each of the first UE and the second UE, wherein the plurality of cyclic shifts are determined relative to a base sequence and based on the distance and the number of UEs sharing the OFDM symbol;

assigning one or more sequences to each of the first UE and the second UE, wherein the one or more sequences assigned to the first UE and the second UE are based on a corresponding plurality of cyclic shifts associated with the first UE and the second UE; and

receiving, at the base station, a multiplexed signal, wherein the multiplexed signal includes at least one bit of uplink control information (UCI) from the first UE and the second UE multiplexed on an uplink short burst transmitted via the OFDM symbol, wherein the at least one bit of UCI includes one or more bits of an acknowledgement (ACKs), negative ACK (NACK) or a scheduling request (SR), and wherein the distance is the user distance, and wherein the user distance is a distance between the first UE and a second UE.

15. The method of claim 14, wherein the user distance is a maximum user distance.

16. A method of wireless communications, comprising:

determining, at a base station, one or more frequency resources for a first user equipment (UE) and a second UE of a plurality of UEs;

~~assigning, at the base station, the determined one or more frequency resources to~~
each of the first UE and the second UE;

~~assign one or more cyclic shifts to each of the first UE and the second UE;~~
assigning, at the base station, one or more cyclic shifts to each of the first UE and the
second UE based on a sequence length and a number of hypotheses, wherein a distance between
the cyclic shifts is a hypothesis distance between a first hypothesis and a second hypothesis
associated with a UE, and wherein the UE is the first UE or the second UE, wherein the first
hypothesis is an ACK and the second hypothesis is a NACK; and

receiving, at the base station, a multiplexed signal, wherein the multiplexed signal
includes at least one bit of uplink control information (UCI) from the first UE and the second UE
based on a frequency division multiplexing (FDM) on an uplink short burst transmitted via an
orthogonal frequency division multiplexing (OFDM) symbol.

17. A base station, comprising:

a memory; and

a processor in communication with the memory and configured to:

determine a plurality of cyclic shifts for each of a first UE and a second UE,
wherein the plurality of cyclic shifts are determined relative to a base sequence and
separated by a hypothesis distance, wherein the hypothesis distance is based on a number
of hypotheses, wherein the hypothesis distance is a distance between a first hypothesis
and a second hypothesis associated with a first UE and a second UE for an orthogonal
frequency division multiplexing (OFDM) symbol;

assign one or more sequences to each of the first UE and the second UE, wherein
the one or more sequences assigned to the first UE and the second UE are based on a
corresponding plurality of cyclic shifts associated with the first UE and the second UE;
and

receive a multiplexed signal, wherein the multiplexed signal includes at least one
bit of uplink control information (UCI) from the first UE and the second UE based on a
frequency division multiplexing (FDM) multiplexed on an uplink short burst transmitted
via an orthogonal frequency division multiplexing (the OFDM) symbol.

18. The base station of claim 17, ~~wherein the one or more frequency resources are located in different bands and~~ wherein the at least one bit of UCI includes one or more bits of an acknowledgement (ACKs), negative ACK (NACK) or a scheduling request (SR).

19. The base station of claim ~~17~~18, wherein the ~~one or more frequency resources are~~distance is based on different combs for random assigning of sequences to the first UE and the second UE.

20. The base station of claim 17, wherein the ~~one or more cyclic shifts have~~hypothesis distance is a maximum hypothesis distance.

21. The base station of claim ~~20~~17, wherein the first hypothesis is an ACK and the second hypothesis is a NACK.

22. The base station of claim 17, wherein the at least one bit of UCI comprises at least one scheduling request (SR) bit, at least one acknowledgement (ACK) bit, or at least one SR bit and at least one ACK bit.

23. The base station of claim 22, wherein the hypothesis distance between two of the plurality of cyclic shifts is 6 for 2 UCI hypothesis from one UE.

~~22~~24. The base station of claim ~~20~~22, wherein the minimum hypothesis distance between any two adjacent cyclic shifts of the plurality of cyclic shifts is 3 for 4 UCI hypothesis from one UE.

~~23. The base station of claim 17, wherein the at least one bit of UCI comprise at least one scheduling request (SR) bit, at least one acknowledgement (ACK) bit, or at least one SR bit and at least one ACK bit.~~

~~24. The base station of claim 23~~25. The base station of claim 22, wherein the at least one bit of UCI comprises at most one scheduling request (SR) bit, at most two acknowledgement (ACK) bits, or at most one SR bit and at most two ACK bits.

26. The base station of claim 17, wherein the sequence has a length of 12 indices.

~~25-27.~~ The base station of claim 17, wherein one cyclic shift includes only a single scheduling request (SR).

~~26-28.~~ The base station of claim 17, wherein the multiplexed signal includes UCI from both the first UE and the second UE.

~~27-29. A method of wireless communications, comprising:~~
~~receiving, at a UE, one or more sequences assigned to the UE by a base station, wherein the one or more sequences are assigned by the base station based on a plurality of cyclic shifts associated with the UE comprising:~~

~~a memory; and determined by~~

~~a processor in communication with the base station relative to a base sequence memory and based on configured to:~~

~~determine a distance between the UE a first user equipment (UE) and a second UE and of a plurality of UEs, wherein the distance is determined based on one or more of a sequence length, a number of hypothesis, or a number of UEs sharing an orthogonal frequency division multiplexing (OFDM) symbol; and~~

~~transmitting, by the UE, uplink control information (UCI) as part of determine a plurality of cyclic shifts for each of the first UE and the second UE, wherein the plurality of cyclic shifts are determined relative to a base sequence and based on the distance and the number of UEs sharing the OFDM symbol;~~

~~assign one or more sequences to each of the first UE and the second UE, wherein the one or more sequences assigned to the first UE and the second UE are based on a corresponding plurality of cyclic shifts associated with the first UE and the second UE; and~~

~~receive a multiplexed signal, wherein the multiplexed signal includes at least one bit of uplink control information (UCI) from the first UE and at the second UE multiplexed on an uplink short burst transmitted via the OFDM symbol, wherein the at least one bit of UCI includes one or more bits of an acknowledgement (ACKs), negative ACK (NACK)~~

or a scheduling request (SR), and wherein the distance is the user distance, and wherein the user distance is a distance between the first UE and a second UE.

~~2830.~~ The methodbase station of claim 2729, wherein the user distance is determined by the base station based on one or more of a sequence length, a number of hypothesis, or the number of UEs sharing the OFDM symbolmaximum user distance.

~~2931.~~ A method of wireless communicationbase station, comprising:

receiving, at the UE, a memory; and

a processor in communication with the memory and configured to:

determine one or more frequency resources and one or more shifts for a first user equipment (UE) and a second UE of a plurality of UEs;

assign the determined by a base stationone or more frequency resources to each of the first UE and the second UE;

transmitting, by the UE, uplink control information (UCI) as part of assign one or more cyclic shifts to each of the first UE and the second UE based on a sequence length and a number of hypotheses, wherein a distance between the cyclic shifts is a hypothesis distance between a first hypothesis and a second hypothesis associated with a UE, and wherein the UE is the first UE or the second UE, wherein the first hypothesis is an ACK and the second hypothesis is a NACK; and

receive a multiplexed signal, wherein the multiplexed signal includes at least one bit of uplink control information (UCI) from the first UE and at the second UE based on a frequency division multiplexing (FDM) on an uplink short burst transmitted via an orthogonal frequency division multiplexing (OFDM) symbol.

~~30.—The32.~~ A method of claim 29wireless communications, comprising:

receiving control information, at a user equipment (UE) from a base station;

mapping, by the UE, uplink control information (UCI) to a signal based on the control information, wherein the one or more frequency resources are located in signal comprises a sequence from a plurality of sequences corresponding to different bands and hypotheses.

wherein the plurality of sequences are determined relative to a base sequence based on a plurality of cyclic shifts, wherein the plurality of cyclic shifts are separated by a hypothesis distance, wherein the hypothesis distance is a distance between a first hypothesis and a second hypothesis associated with the UE, and wherein the first hypothesis is an ACK and the second hypothesis is a NACK; and

transmitting, by the UE, the sequence from the plurality of sequences on an uplink short burst transmitted via an orthogonal frequency division multiplexing (OFDM) symbol, wherein the sequence is mapped from at least one bit of UCI.

33. A method of wireless communication comprising:

receiving, at a user equipment (UE), one or more frequency resources and a plurality of cyclic shifts determined by a base station based on a sequence length and a number of hypotheses, wherein a distance between the cyclic shifts is a hypothesis distance between a first hypothesis and a second hypothesis associated with the UE, and wherein the first hypothesis is an ACK and the second hypothesis is a NACK; and

transmitting, by the UE, uplink control information (UCI) as part of a multiplexed signal, wherein the multiplexed signal includes a sequence shifted by a selected cyclic shift of the plurality of cyclic shifts, wherein the selected cyclic shift is mapped from at least one ~~or more~~ bits of an acknowledgement (ACKs), negative ACK (NACK) or a scheduling request (SR).bit of UCI from the UE based on a frequency division multiplexing (FDM) on an uplink short burst transmitted via an orthogonal frequency division multiplexing (OFDM) symbol.

34. A user equipment (UE) comprising:

a memory; and

a processor in communication with the memory and configured to:

receive control information from a base station;

map, by the UE, uplink control information (UCI) to a signal based on the control information, wherein the signal comprises a sequence from a plurality of sequences corresponding to different hypotheses,

wherein the plurality of sequences are determined relative to a base sequence based on a plurality of cyclic shifts, wherein the plurality of cyclic shifts are separated by

a hypothesis distance, wherein the hypothesis distance is a distance between a first hypothesis and a second hypothesis associated with the UE, and wherein the first hypothesis is an ACK and the second hypothesis is a NACK; and
transmit the sequence from the plurality of sequences on an uplink short burst transmitted via an orthogonal frequency division multiplexing (OFDM) symbol, wherein the sequence is mapped from at least one bit of UCI.