GROUPING AND USE OF SHORT SEQUENCE SIGNALS

CROSS REFERENCE TO RELATED APPLICATIONS

This patent document claims the benefit of priority of International Patent Application No. PCT/CN2017/110525, filed on November 10, 2017. The entire content of the before-mentioned patent application is incorporated by reference as part of the disclosure of this document.

TECHNICAL FIELD

This disclosure is directed generally to digital wireless communications.

BACKGROUND

Mobile telecommunication technologies are moving the world toward an increasingly connected and networked society. In comparison with the existing wireless networks, next generation systems and wireless communication techniques will need to support a much wider range of use-case characteristics and provide a more complex and sophisticated range of access requirements and flexibilities.

Long-Term Evolution (LTE) is a standard for wireless communication for mobile devices and data terminals developed by 3rd Generation Partnership Project (3GPP). LTE Advanced (LTE-A) is a wireless communication standard that enhances the LTE standard. The 5th generation of wireless system, known as 5G, advances the LTE and LTE-A wireless standards and is committed to supporting higher data-rates, large number of connections, ultra-low latency, high reliability and other emerging business needs.

SUMMARY

This disclosure relates to methods, systems, and devices for grouping and using short sequences in wireless communications, such as Physical Uplink Control Channel (PUCCH) and/or short PUCCH transmissions.

In a first aspect, the present disclosure provides a method for wireless communication, comprising: transmitting information to a wireless communication node based on a length-24 target sequence, wherein the length-24 target sequence is a member of a target

sequence set, wherein each length-24 target sequence of the target sequence set corresponds to a sequence of an individual sequence group that includes multiple sequences, and wherein the length-24 target sequence and the sequence of the individual sequence group have a degree of correlation with each other, wherein a group index of the individual sequence group is denoted as u, and wherein the length-24 target sequence corresponds to a mathematical form of $e^{j\pi\varphi(n)/4}, n = 0,1,2,\ldots,23$ that comprises at least one of:

$\varphi(n)$=[-1,-3,-3,1,-1,-1,-3,1,3,-1,-3,-1,-1,-3,1,1,3,1,-3,-1,-1,3,-3,-3] for u=2;

$\varphi(n)$=[-3,3,1,3,-1,1,-3,1,-3,1,-1,-3,-1,-3,-3,-3,-3,-1,-1,-1,1,1,-3,-3] for u=6;

$\varphi(n)$=[-3,-3,1,-1,3,3,-3,-1,1,-1,-1,1,1 -1,-1,3,-3,1,-3,1,-1,-1,-1,-3] for u=16;

$\varphi(n)$=[3,-1,1,-1,3,-3,1,1,3,-1,-3,3,1,-3,3,-1,-1,-1,-1,1,-3,-3,-3,-3] for u = 21; or

$\varphi(n)$=[3-3,-3,-1,3,3,-3,-1,3,1,1,1,3,-1,3,-3,-1,3,-1,3,1,-1,-3,-3] for u=27.

In a second aspect, the present disclosure provides a method for wireless communication, comprising: transmitting information to a wireless communication node based on a length-18 target sequence, wherein the length-18 target sequence is a member of a target sequence set, wherein each length-18 target sequence of the target sequence set corresponds to a sequence of an individual sequence group that includes multiple sequences, and wherein the length-18 target sequence and the sequence of the individual sequence group have a degree of correlation with each other, wherein a group index of the individual sequence group is denoted as u, and wherein the length-18 target sequence corresponds to a mathematical form of $e^{j\pi\varphi(n)/4}, n = 0,1,2,\ldots,17$ that comprises at least one of:

$\varphi(n)$=[-3,-3,3,3,3,1,-3,1,3,3,1,-3,-3,3,-1,-3,-1,1] for u=3;

$\varphi(n)$=[1,1,-3,3,3,1,3,-3,3,-1,1,1,-1,1,-3,-3,-1,3] for u=7;

$\varphi(n)$=[-3,-3,-3,1,-3,3,1,1,3,-3,-3,1,3,-1,3,-3,-3,3] for u=10;

$\varphi(n)$=[-3,-1,-3,-1,-3,1,3,-3,-1,3,3,3,1,-1,-3,3,-1,-3] for u=16;

$\varphi(n)$=[3,-1,-3,1,-3,-3,-3,3,3,-1,1,-3,-1,3,1,1,3,3] for u=23; or

$\varphi(n)$=[-3,-3,3,3,-3,1,3,-1,-3,1,-1,-3,3,-3,-1,-1,-1,3] for u=27.

In a third aspect, the present disclosure provides an apparatus for wireless communication, comprising a memory and a processor, wherein the processor is configured to read code from the memory to: transmit information to a wireless communication node based on

a length-24 target sequence, wherein the length-24 target sequence is a member of a target sequence set, wherein each length-24 target sequence of the target sequence set corresponds to a sequence of an individual sequence group that includes multiple sequences, and wherein the length-24 target sequence and the sequence of the individual sequence group have a degree of correlation with each other, wherein a group index of the individual sequence group is denoted as u, and wherein the length-24 target sequence corresponds to a mathematical form of $e^{j\pi\varphi(n)/4}, n = 0,1,2,\ldots,23$ that comprises at least one of:

$\varphi(n)$=[-1,-3,-3,1,-1,-1,-3,1,3,-1,-3,-1,-1,-3,1,1,3,1,-3,-1,-1,3,-3,-3] for u=2;

$\varphi(n)$=[-3,3,1,3,-1,1,-3,1,-3,1,-1,-3,-1,-3,-3,-3,-3,-1,-1,-1,1,1,-3,-3] for u=6;

$\varphi(n)$=[-3,-3,1,-1,3,3,-3,-1,1,-1,-1,1,1 -1,-1,3,-3,1,-3,1,-1,-1,-1,-3] for u=16;

$\varphi(n)$=[3,-1,1,-1,3,-3,1,1,3,-1,-3,3,1,-3,3,-1,-1,-1,-1,1,-3,-3,-3,-3] for u = 21; or

$\varphi(n)$=[3-3,-3,-1,3,3,-3,-1,3,1,1,1,3,-1,3,-3,-1,3,-1,3,1,-1,-3,-3] for u=27.

In a fourth aspect, the present disclosure provides an apparatus for wireless communication, comprising a memory and a processor, wherein the processor is configured to read code from the memory to: transmit information to a wireless communication node based on a length-18 target sequence, wherein the length-18 target sequence is a member of a target sequence set, wherein each length-18 target sequence of the target sequence set corresponds to a sequence of an individual sequence group that includes multiple sequences, and wherein the length-18 target sequence and the sequence of the individual sequence group have a degree of correlation with each other, wherein a group index of the individual sequence group is denoted as u, and wherein the length-18 target sequence corresponds to a mathematical form of $e^{j\pi\varphi(n)/4}, n = 0,1,2,\ldots,17$ that comprises at least one of:

$\varphi(n)$=[-3,-3,3,3,3,1,-3,1,3,3,1,-3,-3,3,-1,-3,-1,1] for u=3;

$\varphi(n)$=[1,1,-3,3,3,1,3,-3,3,-1,1,1,-1,1,-3,-3,-1,3] for u=7;

$\varphi(n)$=[-3,-3,-3,1,-3,3,1,1,3,-3,-3,1,3,-1,3,-3,-3,3] for u=10;

$\varphi(n)$=[-3,-1,-3,-1,-3,1,3,-3,-1,3,3,3,1,-1,-3,3,-1,-3] for u=16;

$\varphi(n)$=[3,-1,-3,1,-3,-3,-3,3,3,-1,1,-3,-1,3,1,1,3,3] for u=23; or

$\varphi(n)$=[-3,-3,3,3,-3,1,3,-1,-3,1,-1,-3,3,-3,-1,-1,-1,3] for u=27.

In a fifth aspect, the present disclosure provides a non-transitory computer readable program storage medium having code stored thereon, the code, when executed by a processor, causing the processor to implement a method that comprises: transmitting information to a wireless communication node based on a length-24 target sequence, wherein the length-24 target sequence is a member of a target sequence set, wherein each length-24 target sequence of the target sequence set corresponds to a sequence of an individual sequence group that includes multiple sequences, and wherein the length-24 target sequence and the sequence of the individual sequence group have a degree of correlation with each other, wherein a group index of the individual sequence group is denoted as u, and wherein the length-24 target sequence corresponds to a mathematical form of $e^{j\pi\varphi(n)/4}, n = 0,1,2,\ldots,23$ that comprises at least one of:

$\varphi(n)$=[-1,-3,-3,1,-1,-1,-3,1,3,-1,-3,-1,-1,-3,1,1,3,1,-3,-1,-1,3,-3,-3] for u=2;

$\varphi(n)$=[-3,3,1,3,-1,1,-3,1,-3,1,-1,-3,-1,-3,-3,-3,-3,-1,-1,-1,1,1,-3,-3] for u=6;

$\varphi(n)$=[-3,-3,1,-1,3,3,-3,-1,1,-1,-1,1,1 -1,-1,3,-3,1,-3,1,-1,-1,-1,-3] for u=16;

$\varphi(n)$=[3,-1,1,-1,3,-3,1,1,3,-1,-3,3,1,-3,3,-1,-1,-1,-1,1,-3,-3,-3,-3] for u = 21; or

$\varphi(n)$=[3-3,-3,-1,3,3,-3,-1,3,1,1,1,3,-1,3,-3,-1,3,-1,3,1,-1,-3,-3] for u=27;

In a sixth aspect, the present disclosure provides a non-transitory computer readable program storage medium having code stored thereon, the code, when executed by a processor, causing the processor to implement a method that comprises: transmitting information to a wireless communication node based on a length-18 target sequence, wherein the length-18 target sequence is a member of a target sequence set, wherein each length-18 target sequence of the target sequence set corresponds to a sequence of an individual sequence group that includes multiple sequences, and wherein the length-18 target sequence and the sequence of the individual sequence group have a degree of correlation with each other, wherein a group index of the individual sequence group is denoted as u, and wherein the length-18 target sequence corresponds to a mathematical form of $e^{j\pi\varphi(n)/4}, n = 0,1,2,\ldots,17$ that comprises at least one of:

$\varphi(n)$=[-3,-3,3,3,3,1,-3,1,3,3,1,-3,-3,3,-1,-3,-1,1] for u=3;

$\varphi(n)$=[1,1,-3,3,3,1,3,-3,3,-1,1,1,-1,1,-3,-3,-1,3] for u=7;

$\varphi(n)$=[-3,-3,-3,1,-3,3,1,1,3,-3,-3,1,3,-1,3,-3,-3,3] for u=10;

$\varphi(n)$=[-3,-1,-3,-1,-3,1,3,-3,-1,3,3,3,1,-1,-3,3,-1,-3] for u=16;

$\varphi(n)$=[3,-1,-3,1,-3,-3,-3,3,3,-1,1,-3,-1,3,1,1,3,3] for u=23; or

$\varphi(n)$=[-3,-3,3,3,-3,1,3,-1,-3,1,-1,-3,3,-3,-1,-1,-1,3] for u=27.

An exemplary embodiment discloses a method for wireless communication. The method comprises communicating with a wireless communication node based, at least in part, on a distinguished length-X sequence included in a distinguished sequence group, the distinguished

Claims

1. A method for wireless communication, comprising:

transmitting information to a wireless communication node based on a length-24 target sequence, wherein the length-24 target sequence is a member of a target sequence set, wherein each length-24 target sequence of the target sequence set corresponds to a sequence of an individual sequence group that includes multiple sequences, and wherein the length-24 target sequence and the sequence of the individual sequence group have a degree of correlation with each other, wherein a group index of the individual sequence group is denoted as u, and wherein the length-24 target sequence corresponds to a mathematical form of $e^{j\pi\varphi(n)/4}, n = 0,1,2,\ldots,23$ that comprises at least one of:

$\varphi(n)$=[-1,-3,-3,1,-1,-1,-3,1,3,-1,-3,-1,-1,-3,1,1,3,1,-3,-1,-1,3,-3,-3] for u=2;

$\varphi(n)$=[-3,3,1,3,-1,1,-3,1,-3,1,-1,-3,-1,-3,-3,-3,-3,-1,-1,-1,1,1,-3,-3] for u=6;

$\varphi(n)$=[-3,-3,1,-1,3,3,-3,-1,1,-1,-1,1,1 -1,-1,3,-3,1,-3,1,-1,-1,-1,-3] for u=16;

$\varphi(n)$=[3,-1,1,-1,3,-3,1,1,3,-1,-3,3,1,-3,3,-1,-1,-1,-1,1,-3,-3,-3,-3] for u = 21; or

$\varphi(n)$=[3-3,-3,-1,3,3,-3,-1,3,1,1,1,3,-1,3,-3,-1,3,-1,3,1,-1,-3,-3] for u=27.

2. A method for wireless communication, comprising:

transmitting information to a wireless communication node based on a length-18 target sequence, wherein the length-18 target sequence is a member of a target sequence set, wherein each length-18 target sequence of the target sequence set corresponds to a sequence of an individual sequence group that includes multiple sequences, and wherein the length-18 target sequence and the sequence of the individual sequence group have a degree of correlation with each other, wherein a group index of the individual sequence group is denoted as u, and wherein the length-18 target sequence corresponds to a mathematical form of $e^{j\pi\varphi(n)/4}, n = 0,1,2,\ldots,17$ that comprises at least one of:

$\varphi(n)$=[-3,-3,3,3,3,1,-3,1,3,3,1,-3,-3,3,-1,-3,-1,1] for u=3;

$\varphi(n)$=[1,1,-3,3,3,1,3,-3,3,-1,1,1,-1,1,-3,-3,-1,3] for u=7;

$\varphi(n)$=[-3,-3,-3,1,-3,3,1,1,3,-3,-3,1,3,-1,3,-3,-3,3] for u=10;

$\varphi(n)$=[-3,-1,-3,-1,-3,1,3,-3,-1,3,3,3,1,-1,-3,3,-1,-3] for u=16;

$\varphi(n)$=[3,-1,-3,1,-3,-3,-3,3,3,-1,1,-3,-1,3,1,1,3,3] for u=23; or

$\varphi(n)$=[-3,-3,3,3,-3,1,3,-1,-3,1,-1,-3,3,-3,-1,-1,-1,3] for u=27.

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3. The method of claim 1 or 2, wherein the wireless communication node is a base station.

4. An apparatus for wireless communication, comprising a memory and a processor, wherein the processor is configured to read code from the memory to:

transmit information to a wireless communication node based on a length-24 target sequence, wherein the length-24 target sequence is a member of a target sequence set, wherein each length-24 target sequence of the target sequence set corresponds to a sequence of an individual sequence group that includes multiple sequences, and wherein the length-24 target sequence and the sequence of the individual sequence group have a degree of correlation with each other, wherein a group index of the individual sequence group is denoted as u, and wherein the length-24 target sequence corresponds to a mathematical form of $e^{j\pi\varphi(n)/4}, n = 0,1,2,\ldots,23$ that comprises at least one of:

$\varphi(n)$=[-1,-3,-3,1,-1,-1,-3,1,3,-1,-3,-1,-1,-3,1,1,3,1,-3,-1,-1,3,-3,-3] for u=2;

$\varphi(n)$=[-3,3,1,3,-1,1,-3,1,-3,1,-1,-3,-1,-3,-3,-3,-3,-1,-1,-1,1,1,-3,-3] for u=6;

$\varphi(n)$=[-3,-3,1,-1,3,3,-3,-1,1,-1,-1,1,1 -1,-1,3,-3,1,-3,1,-1,-1,-1,-3] for u=16;

$\varphi(n)$=[3,-1,1,-1,3,-3,1,1,3,-1,-3,3,1,-3,3,-1,-1,-1,-1,1,-3,-3,-3,-3] for u = 21; or

$\varphi(n)$=[3-3,-3,-1,3,3,-3,-1,3,1,1,1,3,-1,3,-3,-1,3,-1,3,1,-1,-3,-3] for u=27.

5. An apparatus for wireless communication, comprising a memory and a processor, wherein the processor is configured to read code from the memory to:

transmit information to a wireless communication node based on a length-18 target sequence, wherein the length-18 target sequence is a member of a target sequence set, wherein each length-18 target sequence of the target sequence set corresponds to a sequence of an individual sequence group that includes multiple sequences, and wherein the length-18 target sequence and the sequence of the individual sequence group have a degree of correlation with each other, wherein a group index of the individual sequence group is denoted as u, and wherein

the length-18 target sequence corresponds to a mathematical form of $e^{j\pi\varphi(n)/4}, n = 0,1,2,\ldots,17$ that comprises at least one of:

$\varphi(n)$=[-3,-3,3,3,3,1,-3,1,3,3,1,-3,-3,3,-1,-3,-1,1] for u=3;

$\varphi(n)$=[1,1,-3,3,3,1,3,-3,3,-1,1,1,-1,1,-3,-3,-1,3] for u=7;

$\varphi(n)$=[-3,-3,-3,1,-3,3,1,1,3,-3,-3,1,3,-1,3,-3,-3,3] for u=10;

$\varphi(n)$=[-3,-1,-3,-1,-3,1,3,-3,-1,3,3,3,1,-1,-3,3,-1,-3] for u=16;

$\varphi(n)$=[3,-1,-3,1,-3,-3,-3,3,3,-1,1,-3,-1,3,1,1,3,3] for u=23; or

$\varphi(n)$=[-3,-3,3,3,-3,1,3,-1,-3,1,-1,-3,3,-3,-1,-1,-1,3] for u=27.

6. A non-transitory computer readable program storage medium having code stored thereon, the code, when executed by a processor, causing the processor to implement a method that comprises:

transmitting information to a wireless communication node based on a length-24 target sequence, wherein the length-24 target sequence is a member of a target sequence set, wherein each length-24 target sequence of the target sequence set corresponds to a sequence of an individual sequence group that includes multiple sequences, and wherein the length-24 target sequence and the sequence of the individual sequence group have a degree of correlation with each other, wherein a group index of the individual sequence group is denoted as u, and wherein the length-24 target sequence corresponds to a mathematical form of $e^{j\pi\varphi(n)/4}, n = 0,1,2,\ldots,23$ that comprises at least one of:

$\varphi(n)$=[-1,-3,-3,1,-1,-1,-3,1,3,-1,-3,-1,-1,-3,1,1,3,1,-3,-1,-1,3,-3,-3] for u=2;

$\varphi(n)$=[-3,3,1,3,-1,1,-3,1,-3,1,-1,-3,-1,-3,-3,-3,-3,-1,-1,-1,1,1,-3,-3] for u=6;

$\varphi(n)$=[-3,-3,1,-1,3,3,-3,-1,1,-1,-1,1,1 -1,-1,3,-3,1,-3,1,-1,-1,-1,-3] for u=16;

$\varphi(n)$=[3,-1,1,-1,3,-3,1,1,3,-1,-3,3,1,-3,3,-1,-1,-1,-1,1,-3,-3,-3,-3] for u = 21; or

$\varphi(n)$=[3-3,-3,-1,3,3,-3,-1,3,1,1,1,3,-1,3,-3,-1,3,-1,3,1,-1,-3,-3] for u=27;

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7. A non-transitory computer readable program storage medium having code stored thereon, the code, when executed by a processor, causing the processor to implement a method that comprises:

transmitting information to a wireless communication node based on a length-18 target sequence, wherein the length-18 target sequence is a member of a target sequence set, wherein each length-18 target sequence of the target sequence set corresponds to a sequence of an individual sequence group that includes multiple sequences, and wherein the length-18 target sequence and the sequence of the individual sequence group have a degree of correlation with each other, wherein a group index of the individual sequence group is denoted as u, and wherein the length-18 target sequence corresponds to a mathematical form of $e^{j\pi\varphi(n)/4}, n = 0,1,2,\ldots,17$ that comprises at least one of:

$\varphi(n)$=[-3,-3,3,3,3,1,-3,1,3,3,1,-3,-3,3,-1,-3,-1,1] for u=3;

$\varphi(n)$=[1,1,-3,3,3,1,3,-3,3,-1,1,1,-1,1,-3,-3,-1,3] for u=7;

$\varphi(n)$=[-3,-3,-3,1,-3,3,1,1,3,-3,-3,1,3,-1,3,-3,-3,3] for u=10;

$\varphi(n)$=[-3,-1,-3,-1,-3,1,3,-3,-1,3,3,3,1,-1,-3,3,-1,-3] for u=16;

$\varphi(n)$=[3,-1,-3,1,-3,-3,-3,3,3,-1,1,-3,-1,3,1,1,3,3] for u=23; or

$\varphi(n)$=[-3,-3,3,3,-3,1,3,-1,-3,1,-1,-3,3,-3,-1,-1,-1,3] for u=27.

8. The non-transitory computer readable program storage medium of claim 6 or 7, wherein the wireless communication node is a base station.

9. The method of claim 1 or 2, wherein the individual sequence group includes at least two sequences of different lengths.

10. The method of claim 1 or 2, wherein the sequence of the individual sequence group is based on a length of the sequence.

11. The apparatus of claim 4 or 5, wherein the individual sequence group includes at least two sequences of different lengths.

12. The apparatus of claim 4 or 5, wherein the sequence of the individual sequence group is based on a length of the sequence.

13. The non-transitory computer readable program storage medium of claim 6 or 7, wherein the individual sequence group includes at least two sequences of different lengths.

14. The non-transitory computer readable program storage medium of claim 6 or 7, wherein the sequence of the individual sequence group is based on a length of the sequence.