COMMUNICATION METHOD AND COMMUNICATION APPARATUS

[0001] This application claims priority to Chinese Patent Application No. 202410339909.3, filed with the China National Intellectual Property Administration on March 22, 2024 and entitled "COMMUNICATION METHOD AND COMMUNICATION APPARATUS", which is incorporated herein by reference in its entirety.

TECHNICAL FIELD

[0002] This application relates to the field of communication technologies, and more specifically, to a communication method and a communication apparatus.

BACKGROUND

[0003] Sequences are widely used in long term evolution (long term evolution, LTE)/new radio (new radio, NR) protocols. For example, downlink synchronization signals, uplink random access signals, demodulation reference signals (demodulation reference signals, DMRS), sounding reference signals (sounding reference signals, SRS), and the like all rely on sequences for signal generation.

[0004] Currently, commonly used sequences mainly include pseudo-random sequences (such as m-sequences and Gold sequences), polyphase sequences (such as Zadoff-Chu (ZC) sequences), computer-generated sequences (computer-generated sequences, CGS), and the like.

[0005] As the scale of future communications continues to expand, the foregoing sequences may no longer meet user requirements. For example, the sequences may suffer from low sequence capacity or strong inter-sequence interference. Therefore, how to improve existing sequences is an urgent technical problem to be resolved currently.

SUMMARY

[0006] This application provides a communication method and a communication apparatus to improve existing sequences, thereby meeting user requirements such as increasing sequence capacity or reducing inter-sequence interference.

[0007] According to a first aspect, a communication method is provided, including: determining a polynomial exponent sequence, where a coefficient of a highest-degree term of the polynomial exponent sequence is correlated with a first coefficient, the first coefficient is any one

of coefficients from a coefficient of a second-highest-degree term to a coefficient of a second-degree term of the polynomial exponent sequence, and a degree of the polynomial exponent sequence is greater than or equal to 4; and sending the polynomial exponent sequence.

[0008] The solution in the first aspect may be performed by a first apparatus, may be performed by a module (for example, a chip system) in the first apparatus, or may be performed by a logical node, a logical module, or software that can implement all or some functions of the first apparatus. This is not limited. For ease of description, the following uses the first apparatus as an example for description.

[0009] In the foregoing solution, the coefficient of the highest-degree term is correlated with the first coefficient. This helps avoid peak values in any two polynomial exponent sequences within a specific range, to help distinguish between different polynomial exponent sequences, thereby reducing strong interference between different polynomial exponent sequences, and improving communication performance. In addition, the degree of the polynomial exponent sequence is greater than or equal to 4. This can improve sequence capacity.

[0010] In conclusion, the polynomial exponent sequence whose degree is greater than or equal to 4 is designed, and coefficients of some terms of the polynomial exponent sequence are correlated with each other. This can meet user requirements such as increasing sequence capacity or reducing inter-sequence interference.

[0011] According to a second aspect, a communication method is provided, including: receiving a polynomial exponent sequence, where a coefficient of a highest-degree term of the polynomial exponent sequence is correlated with a first coefficient, the first coefficient is any one of coefficients from a coefficient of a second-highest-degree term to a coefficient of a second-degree term of the polynomial exponent sequence, and a degree of the polynomial exponent sequence is greater than or equal to 4; and processing the polynomial exponent sequence.

[0012] The solution in the second aspect may be performed by a second apparatus, may be performed by a module (for example, a chip system) in the second apparatus, or may be performed by a logical node, a logical module, or software that can implement all or some functions of the second apparatus. This is not limited. For ease of description, the following uses the second apparatus as an example for description.

[0013] With reference to any one of the first aspect and the second aspect, the first coefficient is correlated with a first parameter, and the first parameter is one of a maximum delay spread and a maximum Doppler spread.

[0014] The first coefficient is correlated with the first parameter. In this way, a correlation function of any two polynomial exponent sequences does not exceed a threshold within a specific range of a domain in which the first parameter is located, thereby improving communication

performance.

[0015] With reference to any one of the first aspect and the second aspect, a coefficient of a first-degree term of the polynomial exponent sequence is correlated with a second parameter, the second parameter is one of the maximum delay spread and the maximum Doppler spread, and the first parameter is different from the second parameter.

[0016] The coefficient of the first-degree term is correlated with the second parameter. In this way, a correlation function of any two polynomial exponent sequences is equal to 0 within a specific range of a domain in which the second parameter is located, thereby improving communication performance.

[0017] With reference to any one of the first aspect and the second aspect, the first coefficient is the coefficient of the second-highest-degree term of the polynomial exponent sequence.

[0018] In this way, an ambiguity function of any two polynomial exponent sequences within a range of the maximum delay spread and the maximum Doppler spread is less than a threshold, thereby improving communication performance.

[0019] With reference to any one of the first aspect and the second aspect, the polynomial exponent sequence is $s_{a_D,a_{D-1},\ldots,a_1}(n) = e^{-j2\pi(a_D n^D + a_{D-1} n^{D-1} + \cdots + a_1 n)/N}$, where $n = 0,1,\ldots,N-1$. N is a sequence length of the polynomial exponent sequence, N is a prime number, and D is the degree of the polynomial exponent sequence.

[0020] With reference to any one of the first aspect and the second aspect, the polynomial exponent sequence includes a base sequence and an auxiliary sequence, that is, $s_{a_D,a_{D-1},\ldots,a_1}(n) = u_{a_D}(n) \cdot v_{a_{D-1},a_{D-2},\ldots,a_1}(n)$. The base sequence is $u_{a_D}(n) = e^{-j2\pi a_D n^D/N}$. The auxiliary sequence is $v_{a_{D-1},a_{D-2},\ldots,a_1}(n) = e^{-j2\pi(a_{D-1} n^{D-1} + a_{D-2} n^{D-2} + \cdots + a_1 n)/N}$.

[0021] The base sequence is a sequence correlated with a cell. For example, a same cell corresponds to a same base sequence, and different cells correspond to different base sequences. Alternatively, a same cell corresponds to a plurality of base sequences, and different cells correspond to different base sequences. The auxiliary sequence is a sequence correlated with a terminal device in the cell. For example, different terminal devices in a same cell may correspond to different auxiliary sequences.

[0022] The polynomial exponent sequence is constructed based on the base sequence and the auxiliary sequence. This can distinguish between different cells, and can also distinguish between different terminal devices.

[0023] With reference to any one of the first aspect and the second aspect, the polynomial exponent sequence is mapped by using a time domain resource, the first parameter is the maximum delay spread, and the second parameter is the maximum Doppler spread.

[0024] In this way, the first coefficient is correlated with the maximum delay spread, and the coefficient of the first-degree term is correlated with the maximum Doppler spread. This helps implement a low-ambiguity zone feature, that is, an ambiguity function of any two polynomial exponent sequences within a range of the maximum delay spread and the maximum Doppler spread does not exceed a threshold.

[0025] With reference to the method according to any one of the first aspect and the second aspect, the polynomial exponent sequence is mapped by using the time domain resource, and a discrete-time signal of the polynomial exponent sequence is as follows:

$$\bar{s}_{\lambda_D,\lambda_{D-1},\ldots,\lambda_1}(n) = e^{-j2\pi(\lambda_D n^D + D\lambda_D\lambda_{D-1}\Delta_T n^{D-1} + \lambda_{D-2}n^{D-2} + \cdots + \lambda_2 n^2 + \lambda_1\Delta_F n)/N}.$$

[0026] $\lambda_D \in \{1,2,\ldots,N-1\}, \lambda_{D-1} \in \{0,1,\ldots,\lfloor N/\Delta_T \rfloor - 1\}, \lambda_{D-2},\ldots,\lambda_2 \in \{0,1,\ldots,N-1\}, \lambda_1 \in \{0,1,\ldots,\lfloor N/\Delta_F \rfloor - 1\}$, Δ_T represents the maximum delay spread, and Δ_F represents the maximum Doppler spread. "..." indicates that a value assignment rule of an unshown parameter is the same as a value assignment rule of a shown parameter. For example, $\lambda_{D-3} \in \{0,1,\ldots,N-1\}$.

[0027] According to the polynomial exponent sequence, in this embodiment of this application, sequence capacity can be increased, and a low-ambiguity zone feature can be satisfied.

[0028] With reference to the method according to any one of the first aspect and the second aspect, $D = 4$, and the discrete-time signal of the polynomial exponent sequence is as follows:

$$\bar{s}_{\lambda,\mu,k,l}(n) = e^{-j2\pi(\lambda n^4 + 4\lambda\mu\Delta_T n^3 + kn^2 + l\Delta_F n)/N}.$$

[0029] $\lambda \in \{1,2,\ldots,N-1\}, \mu \in \{0,1,\ldots,\lfloor N/\Delta_T \rfloor - 1\}, k \in \{0,1,\ldots,N-1\}, l \in \{0,1,\ldots,\lfloor N/\Delta_F \rfloor - 1\}$. $\lambda = \lambda_4$, $\mu = \lambda_3$, $k = \lambda_2$, and $l = \lambda_1$.

[0030] According to the polynomial exponent sequence, in this embodiment of this application, sequence capacity can be increased, and a low-ambiguity zone feature can be satisfied.

[0031] With reference to any one of the first aspect and the second aspect, the polynomial exponent sequence is mapped by using a frequency domain resource, the first parameter is the maximum Doppler spread, and the second parameter is the maximum delay spread.

[0032] In this way, the first coefficient is correlated with the maximum Doppler spread, and the coefficient of the first-degree term is correlated with the maximum delay spread. This helps implement a low-ambiguity zone feature, that is, an ambiguity function of any two polynomial exponent sequences within a range of the maximum delay spread and the maximum Doppler spread does not exceed a threshold.

[0033] With reference to any one of the first aspect and the second aspect, the polynomial exponent sequence is mapped by using the frequency domain resource, and a discrete-time signal of the polynomial exponent sequence is as follows:

$$\bar{s}_{\lambda_D,\lambda_{D-1},\ldots,\lambda_1}(n) = \frac{1}{\sqrt{N}}\sum_{m=0}^{N-1} e^{-j2\pi(\lambda_D m^D + D\lambda_D\lambda_{D-1}\Delta_F m^{D-1} + \lambda_{D-2}m^{D-2} + \cdots + \lambda_2 m^2 + \lambda_1\Delta_T m)/N} \cdot e^{j2\pi mn/N}.$$

[0034] $\lambda_D \in \{1,2,\dots,N-1\}, \lambda_{D-1} \in \{0,1,\dots,\lfloor N/\Delta_F \rfloor - 1\}, \lambda_{D-2},\dots,\lambda_2 \in \{0,1,\dots,N-1\}, \lambda_1 \in \{0,1,\dots,\lfloor N/\Delta_T \rfloor - 1\}$. "..." indicates that a value assignment rule of an unshown parameter is the same as a value assignment rule of a shown parameter. For example, $\lambda_{D-3} \in \{0,1,\dots,N-1\}$.

[0035] According to the polynomial exponent sequence, in this embodiment of this application, sequence capacity can be increased, and a low-ambiguity zone feature can be satisfied.

[0036] With reference to any one of the first aspect and the second aspect, $D = 4$, and the discrete-time signal of the polynomial exponent sequence is as follows:

$$\bar{s}_{\lambda,\mu,k,l}(n) = \frac{1}{\sqrt{N}} \sum_{m=0}^{N-1} e^{-j2\pi(\lambda m^4 + 4\lambda\mu\Delta_F m^3 + km^2 + l\Delta_T m)/N} \cdot e^{j2\pi mn/N}.$$

[0037] $\lambda \in \{1,2,\dots,N-1\}, \mu \in \{0,1,\dots,\lfloor N/\Delta_F \rfloor - 1\}, k \in \{0,1,\dots,N-1\}, l \in \{0,1,\dots,\lfloor N/\Delta_T \rfloor - 1\}$. $\lambda = \lambda_4$, $\mu = \lambda_3$, $k = \lambda_2$, and $l = \lambda_1$.

[0038] According to the fourth-degree polynomial exponent sequence, in this embodiment of this application, sequence capacity can be increased, and a low-ambiguity zone feature can be satisfied.

[0039] With reference to any one of the first aspect and the second aspect, a maximum value of an ambiguity function of the polynomial exponent sequence does not exceed $(D-1)\sqrt{N}$.

[0040] In this way, the polynomial exponent sequence can meet a low-ambiguity zone feature.

[0041] With reference to any one of the first aspect and the second aspect, sequence capacity of the polynomial exponent sequence is $(N-1) \cdot N^{D-3} \cdot \lfloor N/\Delta_T \rfloor \cdot \lfloor N/\Delta_F \rfloor$.

[0042] In this way, the polynomial exponent sequence can meet a requirement for high sequence capacity.

[0043] With reference to any one of the first aspect and the second aspect, the method further includes: determining indication information, where the indication information indicates the polynomial exponent sequence.

[0044] In this way, the first apparatus may indicate the polynomial exponent sequence by the indication information.

[0045] With reference to any one of the first aspect and the second aspect, the indication information includes one or more coefficients of the polynomial exponent sequence.

[0046] In this way, the first apparatus may indicate the polynomial exponent sequence by the one or more coefficients included in the indication information.

[0047] According to a third aspect, a communication apparatus is provided. The communication apparatus may be a first apparatus, or may be a device, a module, or the like configured to perform functions of the first apparatus.

[0048] The communication apparatus may include modules or units that are in one-to-one

correspondence with the methods/operations/steps/actions described in the first aspect. The module or unit may be implemented by a hardware circuit, software, or a combination of the hardware circuit and the software.

[0049] For example, the communication apparatus includes a processing unit and a transceiver unit. The processing unit is configured to determine the foregoing polynomial exponent sequence. The transceiver unit is configured to send the polynomial exponent sequence.

[0050] According to a fourth aspect, a communication apparatus is provided. The communication apparatus may be a second apparatus, or may be a device, a module, or the like configured to perform functions of the second apparatus.

[0051] The communication apparatus may include modules or units that are in one-to-one correspondence with the methods/operations/steps/actions described in the second aspect. The module or unit may be implemented by a hardware circuit, software, or a combination of the hardware circuit and the software.

[0052] For example, the communication apparatus includes a processing unit and a transceiver unit. The transceiver unit is configured to receive the foregoing polynomial exponent sequence. The processing unit is configured to process the polynomial exponent sequence.

[0053] According to a fifth aspect, a communication apparatus is provided. The communication apparatus includes a processor. The processor is configured to enable, by executing a computer program or instructions or via a logic circuit, the communication apparatus to perform the method according to any one of the first aspect and the possible manners of the first aspect, or the communication apparatus to perform the method according to any one of the second aspect and the possible manners of the second aspect.

[0054] The communication apparatus further includes a memory, configured to store the computer program or the instructions.

[0055] The communication apparatus further includes a communication interface, configured to input and/or output signals.

[0056] According to a sixth aspect, a communication apparatus is provided. The communication apparatus includes a logic circuit and an input/output interface. The input/output interface is configured to input and/or output signals. The logic circuit is configured to perform the method according to any one of the first aspect and the possible manners of the first aspect, or the logic circuit is configured to perform the method according to any one of the second aspect and the possible manners of the second aspect.

[0057] According to a seventh aspect, a computer-readable storage medium is provided. The computer-readable storage medium stores a computer program or instructions. When the computer program is or the instructions are executed on a computer, the method according to any one of the

first aspect and the possible manners of the first aspect is performed, or the method according to any one of the second aspect and the possible manners of the second aspect is performed.

[0058] According to an eighth aspect, a computer program product is provided. The computer program product includes instructions. When the instructions are executed on a computer, the method according to any one of the first aspect and the possible manners of the first aspect is performed, or the method according to any one of the second aspect and the possible manners of the second aspect is performed.

[0059] According to a ninth aspect, a chip system is provided. The chip system includes a processor. The processor is configured to execute a computer program or instructions in a memory, to enable the chip system to implement the method according to any one of the first aspect and the possible implementations of the first aspect, or enable the chip system to implement the method according to any one of the second aspect and the possible implementations of the second aspect.

[0060] For descriptions of beneficial effects of any one of the third aspect to the ninth aspect, refer to the descriptions of the beneficial effects of the first aspect and the second aspect. Details are not described again.

BRIEF DESCRIPTION OF DRAWINGS

[0061] FIG. 1 is a diagram of a communication system to which an embodiment of this application is applicable;

[0062] FIG. 2 is a diagram of an interaction procedure of a communication method according to an embodiment of this application;

[0063] FIG. 3 is a block diagram of a communication apparatus according to an embodiment of this application; and

[0064] FIG. 4 is a block diagram of another communication apparatus according to an embodiment of this application.

DESCRIPTION OF EMBODIMENTS

[0065] For ease of understanding of embodiments of this application, the following descriptions are provided first.

[0066] 1. Unless otherwise stated, "a plurality of" means two or more.

[0067] 2. Unless otherwise stated or there is a logic conflict, terms and/or descriptions in different embodiments of this application are consistent and may be mutually referenced, and technical features in different embodiments may be combined into a new embodiment based on an

internal logical relationship thereof.

[0068] 3. Various numbers in this application are merely used for differentiation for ease of description, but are not intended to limit the protection scope of this application. Sequence numbers in this application do not mean an execution sequence, and an execution sequence of processes should be determined based on functions and internal logic of the processes. For example, in this specification, the claims, and the accompanying drawings of this application, the terms "first", "second", "third", "fourth", and various other term numerals (if existent) are intended to distinguish between similar objects, but do not necessarily indicate a specific order or sequence. Data termed in such a way is interchangeable in proper circumstances so that embodiments described herein can be implemented in an order other than that in the content illustrated or described herein.

[0069] In addition, any embodiment or design solution described as "an example" or "for example" in this application should not be explained as being more preferred or having more advantages than another embodiment or design solution. Specifically, use of the words such as "an example" or "for example" is intended to present a related concept in a specific manner for ease of understanding.

[0070] 4. The terms "include", "have", and any variants thereof are intended to cover non-exclusive inclusion. For example, a process, a method, a system, a product, or a device that includes a series of steps or units is not necessarily limited to steps or units that are clearly listed, but may include other steps or units that are not clearly listed or inherent to the process, the method, the product, or the device.

[0071] 5. In this application, "indicate" may be understood as "enable", and "enable" may include directly enabling and indirectly enabling. When a piece of information is described to enable A, the information may directly enable A or indirectly enable A, but it does not mean that the information definitely carries A.

[0072] Information enabled by the information is referred to as to-be-enabled information. In a specific implementation process, there are many manners of enabling the to-be-enabled information, for example, but not limited to, a manner in which the to-be-enabled information, for example, the to-be-enabled information or an index of the to-be-enabled information, may be directly enabled. Alternatively, the to-be-enabled information may be indirectly enabled by enabling other information, where there is an association relationship between the other information and the to-be-enabled information. Alternatively, only one part of the to-be-enabled information may be enabled, and the other part of the to-be-enabled information may be known or pre-agreed on. For example, specific information may alternatively be enabled according to an arrangement sequence of a plurality of pieces of information that is pre-agreed on (for example,

specified in a protocol), to reduce enabling overheads to some extent. In addition, a common part of all information may be identified and enabled in a unified manner, to reduce enabling overheads caused by enabling the same information separately.

[0073] 6. In this application, "pre-configure" may include "pre-define", for example, define in a protocol. "Pre-define" may be implemented by pre-storing corresponding code or a corresponding table in a device (for example, including network elements), or may be implemented in another manner that may indicate related information. A specific implementation thereof is not limited in this application.

[0074] 7. "Storage" or "store" in this application may mean storage in one or more memories. The one or more memories may be separately disposed, or may be integrated into an encoder, a decoder, a processor, or a communication apparatus. Alternatively, the one or more memories may be partially separately disposed, and partially integrated into a decoder, a processor, or a communication apparatus. A type of the memory may be a storage medium in any form. This is not limited.

[0075] 8. The "protocol" in this application may be a standard protocol in the communication field, for example, may include a 4th generation (4th generation, 4G) network protocol, a 5th generation (5th generation, 5G) network protocol, an NR protocol, a 5.5G network protocol, a 6th generation (6th generation, 6G) network protocol, and a related protocol applied to a future communication system. This is not limited in this application.

[0076] 9. Arrows or blocks shown by dashed lines in diagrams of the accompanying drawings in this specification of this application indicate optional steps or optional modules.

[0077] 10. Unless otherwise stated, "/" indicates an "or" relationship between associated objects. For example, A/B may indicate A or B. "And/or" in this application describes only an association relationship of associated objects and indicates that three relationships may exist. For example, A and/or B may indicate the following three cases: Only A exists, both A and B exist, and only B exists, where A and B may be singular or plural.

[0078] 11. In this application, "indication" may include a direct indication, an indirect indication, an explicit indication, and an implicit indication. When a piece of indication information is described as indicating A, it may be understood as that the indication information carries A, directly indicates A, or indirectly indicates A.

[0079] In this application, information indicated by the indication information is referred to as to-be-indicated information. In a specific implementation process, there are many manners of indicating the to-be-indicated information, for example, but not limited to, a manner in which the to-be-indicated information, for example, the to-be-indicated information or an index of the to-be-indicated information, may be directly indicated. Alternatively, the to-be-indicated information

may be indirectly indicated by indicating other information, and there is an association relationship between the other information and the to-be-indicated information. Alternatively, only one part of the to-be-indicated information may be indicated, and the other part of the to-be-indicated information may be known or pre-agreed on. For example, specific information may alternatively be indicated according to an arrangement sequence of a plurality of pieces of information that is pre-agreed on (for example, specified in a protocol), to reduce indication overheads to some extent. In addition, the to-be-indicated information may be sent together as a whole, or may be divided into a plurality of pieces of sub-information and sent separately. In addition, sending periodicities and/or sending occasions of these pieces of sub-information may be the same or different.

[0080] 12. In this application, "sending" and "receiving" indicate signal transmission directions. For example, "sending information to XX" may be understood as that a destination of the information is XX, and may include direct sending over an air interface, or include indirect sending via another unit or module over an air interface. "Receiving information from YY" may be understood as that a source of the information is YY, and may include direct receiving from YY over an air interface, or may include indirect receiving from YY via another unit or module over an air interface. The "sending" may also be understood as "outputting" of a chip interface, and the "receiving" may also be understood as "inputting" of a chip interface. In other words, sending and receiving may be performed between devices, for example, performed between a network device and a terminal device; or sending or receiving may be performed in a device, for example, performed between components, modules, chips, software modules, or hardware modules in a device via a bus, a trace, or an interface.

[0081] The technical solutions provided in this application may be applied to various communication systems, for example, a 5G or NR system, an LTE system, an LTE frequency division duplex (frequency division duplex, FDD) system, and an LTE time division duplex (time division duplex, TDD) system. The technical solutions provided in this application may be further applied to a future communication system, for example, a 6G communication system.

[0082] The technical solutions provided in this application may be further applied to device-to-device (device-to-device, D2D) communication, vehicle-to-everything (vehicle-to-everything, V2X) communication, machine-to-machine (machine-to-machine, M2M) communication, machine type communication (machine type communication, MTC), an internet of things (internet of things, IoT) communication system, or another communication system.

[0083] The terminal device in embodiments of this application includes various devices having a wireless communication function, and the terminal device may be configured to be connected to a human, an object, a machine, and the like. The terminal device may be widely used in various scenarios, such as cellular communication, D2D, V2X, peer-to-peer (peer-to-peer, P2P), M2M,

MTC, IoT, virtual reality (virtual reality, VR), augmented reality (augmented reality, AR), industrial control, automated driving, telemedicine, a smart grid, smart furniture, a smart office, smart wearable, smart transportation, a smart city, an uncrewed aerial vehicle, a robot, remote sensing, passive sensing, positioning, navigation and tracking, and autonomous delivery.

[0084] The terminal device may be a terminal in any one of the foregoing scenarios, such as an MTC terminal or an IoT terminal. The terminal device may be a user equipment (user equipment, UE) in a 3rd generation partnership project (3rd generation partnership project, 3GPP) standard, a terminal (terminal), a fixed device, a mobile station (mobile station) device or a mobile device, a subscriber unit (subscriber unit), a handheld device, a vehicle-mounted device, a wearable device, a cellular phone (cellular phone), a smartphone (smartphone), a SIP phone, a wireless data card, a personal digital assistant (personal digital assistant, PDA), a computer, a tablet computer, a notebook computer, a wireless modem, a handset (handset), a laptop computer (laptop computer), a computer having a wireless transceiver function, a smart book, a vehicle, a satellite, a global positioning system (global positioning system, GPS) device, a target tracking device, an aircraft (for example, an uncrewed aerial vehicle, a helicopter, a multi-helicopter, a quadcopter, or an airplane), a ship, a remote control device, a smart home device, an industrial device, an apparatus built in the foregoing device (for example, a communication module, a modem, or a chip in the foregoing device), or another processing device connected to a wireless modem. For ease of description, the following provides descriptions by using an example in which the terminal device is a terminal or a UE.

[0085] In some scenarios, the terminal device may alternatively serve as a base station. For example, the terminal device may serve as a scheduling entity, and provide a sidelink (sidelink) signal between UEs in a scenario such as V2X, D2D, or P2P.

[0086] In embodiments of this application, an apparatus configured to implement a function of the terminal device may be the terminal device, or may be an apparatus that can support the terminal device in implementing the function, for example, a chip system or a chip. The apparatus may be installed in the terminal device. In embodiments of this application, the chip system may include a chip, or may include a chip and another discrete device.

[0087] The network device in embodiments of this application may be a device for communicating with the terminal device. The network device may also be referred to as an access network device or a radio access network device. For example, the network device may be a base station. The network device in embodiments of this application may be a radio access network (radio access network, RAN) node (or device) that connects the terminal device to a wireless network. The base station may cover the following various names in a broad sense, or may be replaced with the following names, such as a NodeB (NodeB), an evolved NodeB (evolved NodeB,

eNB), a next generation NodeB (next generation NodeB, gNB), a relay station, an access point, a transmitting and receiving point (transmitting and receiving point, TRP), a transmitting point (transmitting point, TP), a primary station, a secondary station, a multi-standard radio (multi-standard radio, MSR) node, a home base station, a network controller, an access node, a wireless node, an access point (AP), a transmission node, a transceiver node, a baseband unit (BBU), a remote radio unit (remote radio unit, RRU), an active antenna unit (active antenna unit, AAU), a remote radio head (remote radio head, RRH), a central unit (central unit, CU), a distributed unit (distributed unit, DU), and a positioning node. The base station may be a macro base station, a micro base station, a relay node, a donor node, or the like, or a combination thereof. The base station may alternatively be a communication module, a modem, or a chip disposed in the foregoing device or apparatus. The base station may alternatively be a mobile switching center, a device that bears a base station function in D2D, V2X, or M2M communication, a network side device in a 6G network, a device that bears a base station function in a future communication system, or the like. The base station may support networks using a same access technology or different access technologies. Embodiments of this application constitute no limitation on a specific technology and a specific device form used by the network device.

[0088] The base station may be fixed or mobile. For example, a helicopter or an uncrewed aerial vehicle may be configured as a mobile base station, and one or more cells may move based on a position of the mobile base station. In other examples, a helicopter or an uncrewed aerial vehicle may be configured as a device for communicating with another base station.

[0089] In embodiments of this application, an apparatus configured to implement a function of the network device may be the network device, or may be an apparatus that can support the network device in implementing the function, for example, a chip system or a chip. The apparatus may be installed in the network device. In embodiments of this application, the chip system may include a chip, or may include a chip and another discrete device.

[0090] The network device and the terminal device may be deployed on land, including an indoor or outdoor device, a handheld device, or a vehicle-mounted device; may be deployed on a water surface; or may be deployed on an airplane, a balloon, and a satellite in the air. A scenario in which the network device and the terminal device are located is not limited in embodiments of this application.

[0091] FIG. 1 is a diagram of a communication system to which an embodiment of this application is applicable. As shown in FIG. 1, the communication system includes a radio access network (radio access network, RAN) 100 and a core network (core network, CN) 200. The RAN 100 includes at least one RAN node (for example, 110a and 110b, collectively referred to as 110) and at least one terminal device (for example, 120a to 120j, collectively referred to as 120). The

RAN 100 may further include another RAN node, for example, a wireless relay device and/or a wireless backhaul device (not shown in FIG. 1). The terminal device 120 is connected to the RAN node 110 in a wireless manner. The RAN node 110 is connected to the core network 200 in a wireless or wired manner. A core network device in the core network 200 and the RAN node 110 in the RAN 100 may be different physical devices, or may be a same physical device that integrates a logical function of the core network and a logical function of the radio access network.

[0092] The RAN 100 may be a 3GPP-related cellular system, for example, a 4G or 5G mobile communication system, or a future-oriented evolved system (for example, a 6G mobile communication system). The RAN 100 may alternatively be an open radio access network (open RAN, O-RAN or ORAN), a cloud radio access network (cloud RAN, CRAN), or a wireless fidelity (wireless fidelity, Wi-Fi) system. The RAN 100 may alternatively be a communication system that integrates two or more of the foregoing systems.

[0093] The RAN node 110 sometimes may also be referred to as an access network device, a RAN entity, an access node, or the like, and constitutes a part of the communication system, to help the terminal device implement radio access. A plurality of RAN nodes 110 in the communication system may be nodes of a same type, or may be nodes of different types. In some scenarios, roles of the RAN node 110 and the terminal device 120 are relative. For example, the network element 120i may be a helicopter or an uncrewed aerial vehicle, and may be configured as a mobile base station. For the terminal device 120j that accesses the RAN 100 via the network element 120i, the network element 120i is a base station. However, for the base station 110a, the network element 120i is a terminal device. The RAN node 110 and the terminal 120 are sometimes both referred to as communication apparatuses. For example, the network elements 110a and 110b may be understood as communication apparatuses having a base station function, and the network elements 120a to 120j may be understood as communication apparatuses having a terminal function.

[0094] In a possible scenario, the RAN node may be a BS, an eNodeB, an access point (access point, AP), a TRP, a gNB, a next-generation base station in a 6G mobile communication system, a base station in a future mobile communication system, an access node in a Wi-Fi system, or the like. The RAN node may be a macro base station (for example, 110a in FIG. 1), a micro base station or an indoor station (for example, 110b in FIG. 1), a relay node or a donor node, or a radio controller in a CRAN scenario.

[0095] Optionally, the RAN node may alternatively be a server, a wearable device, a vehicle, a vehicle-mounted device, or the like. For example, an access network device in a V2X technology may be a roadside unit (roadside unit, RSU) or a base station. All or some functions of the RAN node in this application may alternatively be implemented by a software function executed on

hardware, or may be implemented by a virtualization function instantiated on a platform (for example, a cloud platform). The RAN node in this application may alternatively be a logical node, a logical module, or software that can implement all or some functions of the RAN node.

[0096] In another possible scenario, a plurality of RAN nodes coordinate to assist the terminal device in implementing radio access, and different RAN nodes each implement some functions of a base station. For example, the RAN node may be a central unit (central unit, CU), a distributed unit (distributed unit, DU), a CU-control plane (control plane, CP), a CU-user plane (user plane, UP), or a radio unit (radio unit, RU). The CU and the DU may be separately disposed, or may be included in a same network element, for example, a baseband unit (baseband unit, BBU). The RU may be included in a radio frequency device or a radio frequency unit, for example, included in a remote radio unit (remote radio unit, RRU), an active antenna unit (active antenna unit, AAU), or a remote radio head (remote radio head, RRH).

[0097] In different communication systems, the CU (or the CU-CP and the CU-UP), the DU, or the RU may also have different names, but a person skilled in the art may understand meanings thereof. For example, in an open radio access network (open radio access network, ORAN) system, the CU may also be referred to as an O-CU (open CU), the DU may also be referred to as an O-DU, the CU-CP may also be referred to as an O-CU-CP, the CU-UP may also be referred to as an O-CU-UP, and the RU may also be referred to as an O-RU. For ease of description, the CU, the CU-CP, the CU-UP, the DU, and the RU are used as examples for description in this application. Any one of the CU (or the CU-CP and the CU-UP), the DU, and the RU in this application may be implemented by a software module, a hardware module, or a combination of the software module and the hardware module.

[0098] Quantities of devices in the communication system are merely used as examples, and are not limited thereto. During actual application, the communication system may alternatively include more terminal devices and more RAN devices, or may further include other devices.

[0099] FIG. 1 is a simplified diagram of an example for ease of understanding. The communication system may alternatively include more network devices or terminal devices. Embodiments of this application are applicable to any communication scenario in which a transmitter device communicates with a receiver device.

[00100] For ease of understanding, the following briefly describes terms in embodiments of this application.

[00101] 1. Ambiguity function

[00102] Ambiguity functions include an auto-ambiguity function and a cross-ambiguity function.

[00103] The auto-ambiguity function indicates correlation between a signal #1 and a signal #2.

The signal #2 is a signal obtained after the signal #1 is affected by a delay and a Doppler frequency shift.

[00104] The cross-ambiguity function indicates correlation between a signal #A and a signal #B. The signal #A is a signal obtained after a signal #C is affected by a delay and a Doppler frequency shift, and the signal #B and the signal #C are located in a same sequence set.

[00105] For example, an auto-ambiguity function of a signal $u(n)$ is defined as follows:

$$A_u(\tau) = \sum_{n=0}^{N-1} u(n)u^*[(n-\tau) \bmod N]e^{j2\pi n\nu/N} \quad (1).$$

[00106] For example, a cross-ambiguity function of a signal $u(n)$ and a signal $v(n)$ is defined as follows:

$$A_{uv}(\tau) = \sum_{n=0}^{N-1} u(n)v^*[(n-\tau) \bmod N]e^{j2\pi n\nu/N} \quad (2).$$

[00107] τ represents a delay, ν represents a Doppler frequency shift, j represents an imaginary unit, $j^2 = -1$, and the superscript $*$ represents a complex conjugate.

[00108] (2) Zero-ambiguity zone

[00109] The zero-ambiguity zone indicates that ambiguity functions (including an auto-ambiguity function and a cross-ambiguity function) are equal to 0 within a specific delay-Doppler range.

[00110] For example, for a cross-ambiguity function, a zero-ambiguity zone of a signal $u(n)$ and a signal $v(n)$ is represented as follows: $\forall \tau \in [0, \Delta_T - 1], \nu \in [0, \Delta_F - 1]$

$$A_{uv}(\tau) = \begin{cases} N, & u = v, \tau = 0, \nu = 0 \\ 0, & (u \neq v) \vee (\tau \neq 0) \vee (\nu \neq 0) \end{cases} \quad (3).$$

[00111] The operator $\vee$ represents a condition OR.

[00112] (3) Low-ambiguity zone

[00113] The low-ambiguity zone indicates that ambiguity functions (including an auto-ambiguity function and a cross-ambiguity function) are less than a threshold within a specific delay-Doppler range.

[00114] For example, for a cross-ambiguity function, a low-ambiguity zone of a signal $u(n)$ and a signal $v(n)$ is represented as follows: $\forall \tau \in [0, \Delta_T - 1], \nu \in [0, \Delta_F - 1]$

$$A_{uv}(\tau) = \begin{cases} N, & u = v, \tau = 0, \nu = 0 \\ \leq \delta, & (u \neq v) \vee (\tau \neq 0) \vee (\nu \neq 0) \end{cases} \quad (4).$$

[00115] (4) Zero-correlation zone

[00116] The zero-correlation zone indicates that correlation functions (including an auto-correlation function and a cross-correlation function) are equal to 0 within a specific delay range.

[00117] An auto-correlation function of a signal $u(n)$ is defined as follows:

$$C_u(\tau) = \sum_{n=0}^{N-1} u(n)u^*[(n-\tau) \bmod N] \quad (5).$$

[00118] A cross-correlation function of a signal $u(n)$ and a signal $v(n)$ is defined as follows:

$$C_{uv}(\tau) = \sum_{n=0}^{N-1} u(n)v^*[(n-\tau) \bmod N] \quad (6).$$

[00119] For example, for a cross-correlation function, a zero-correlation zone of a signal $u(n)$ and a signal $v(n)$ is represented as follows: $\forall \tau \in [0, \Delta_T - 1]$

$$C_{uv}(\tau) = \begin{cases} N, & u = v, \tau = 0 \\ 0, & (u \neq v) \vee (\tau \neq 0) \end{cases} \quad (7).$$

[00120] (5) Low-correlation zone

[00121] The low-correlation zone indicates that correlation functions (including an auto-correlation function and a cross-correlation function) are less than a threshold within a specific delay range.

[00122] For example, for a cross-correlation function, a low-correlation zone of a signal $u(n)$ and a signal $v(n)$ is represented as follows: $\forall \tau \in [0, \Delta_T - 1]$

$$C_{uv}(\tau) = \begin{cases} N, & u = v, \tau = 0 \\ \leq \delta, & (u \neq v) \vee (\tau \neq 0) \end{cases} \quad (8).$$

[00123] (6) Sequence capacity

[00124] The sequence capacity indicates a quantity of sequences included in a sequence set.

[00125] To resolve the technical problem described in the background, in this application, a polynomial exponent sequence whose degree is greater than or equal to 4 is designed, and some coefficients of the polynomial exponent sequence are correlated with each other. In this way, the polynomial exponent sequence can meet user requirements such as high sequence capacity or reduced inter-sequence interference. For specific descriptions, refer to the following.

[00126] For ease of understanding and description, the following describes a communication method in embodiments of this application by using interaction between a first apparatus and a second apparatus as an example. However, this should not constitute any limitation on an execution body of the communication method in embodiments of this application. For example, a method performed by an apparatus (for example, the first apparatus and/or the second apparatus) may alternatively be performed by a module (for example, a circuit, a chip, or a chip system) in the apparatus, or may be implemented by a logical node, a logical module, software, or the like that can implement all or some functions of the apparatus.

[00127] The first apparatus and the second apparatus may be deployed in a same device. For example, the first apparatus and the second apparatus are both deployed in a terminal device, and interaction between the first apparatus and the second apparatus belongs to interaction between different modules of the terminal device. For another example, the first apparatus and the second apparatus are both deployed in a network device, and interaction between the first apparatus and the second apparatus belongs to interaction between different modules of the network device. In this way, interaction between the first apparatus and the second apparatus belongs to interaction

between different modules in one device.

[00128] Alternatively, the first apparatus and the second apparatus may be separately deployed in different devices. For example, the first apparatus is deployed in a terminal device, and the second apparatus is deployed in a network device. For another example, the first apparatus is deployed in a network device, and the second apparatus is deployed in a terminal device. In this way, interaction between the first apparatus and the second apparatus belongs to interaction between different devices. For another example, the first apparatus and the second apparatus are separately deployed in terminal devices. For example, the first apparatus is deployed in a first terminal device, and the second apparatus is deployed in a second terminal device.

[00129] In conclusion, deployment forms of the first apparatus and the second apparatus are not limited in this application.

[00130] FIG. 2 is a diagram of an interaction procedure of a communication method according to an embodiment of this application. As shown in FIG. 2, the method includes the following steps.

[00131] Optionally, in S201, a first apparatus determines (or generates or constructs) a polynomial exponent sequence.

[00132] A highest degree of the polynomial exponent sequence is greater than or equal to 4. For ease of description, the following uses a D^{th}-degree polynomial exponent sequence to represent the polynomial exponent sequence. D is a positive integer greater than or equal to 4.

[00133] A D^{th}-degree polynomial exponent sequence may include coefficients of D terms: a coefficient of a highest-degree term (for example, a coefficient of a D^{th}-degree term), a coefficient of a second-highest-degree term (for example, a coefficient of a $(D-1)^{\text{th}}$-degree term), ..., a coefficient of a second-degree term, and a coefficient of a first-degree term. Values of some or all of coefficients of remaining terms may be 0 except that a value of the coefficient of the highest-degree term cannot be 0.

[00134] For example, the D^{th}-degree polynomial exponent sequence is a fourth-degree polynomial exponent sequence. A fourth-degree polynomial exponent sequence may include a coefficient of a fourth-degree term, a coefficient of a third-degree term, a coefficient of a second-degree term, and a coefficient of a first-degree term.

[00135] For example, the D^{th}-degree polynomial exponent sequence is a fifth-degree polynomial exponent sequence. A fifth-degree polynomial exponent sequence may include a coefficient of a fifth-degree term, a coefficient of a fourth-degree term, a coefficient of a third-degree term, a coefficient of a second-degree term, and a coefficient of a first-degree term.

[00136] Coefficients of some terms of the D^{th}-degree polynomial exponent sequence are correlated with each other. For example, a coefficient of a highest-degree term of the D^{th}-degree

polynomial exponent sequence is correlated with a first coefficient of the D^{th}-degree polynomial exponent sequence, and the first coefficient is any one of coefficients from a coefficient of a second-highest-degree term of the D^{th}-degree polynomial exponent sequence to a coefficient of a second-degree term of the D^{th}-degree polynomial exponent sequence.

[00137] Alternatively, the D^{th}-degree polynomial exponent sequence includes three types of coefficients of terms: the coefficient of the highest-degree term, the first coefficient, and a second coefficient. The second coefficient is a coefficient, other than the first coefficient, in the coefficient of the second-highest-degree term to the coefficient of the second-degree term. The coefficient of the highest-degree term is correlated with the first coefficient. The second coefficient is not limited in this embodiment of this application.

[00138] For example, the coefficient of the highest-degree term of the D^{th}-degree polynomial exponent sequence is correlated with the coefficient of the second-highest-degree term of the D^{th}-degree polynomial exponent sequence.

[00139] For example, the coefficient of the highest-degree term of the D^{th}-degree polynomial exponent sequence is correlated with the coefficient of the second-degree term of the D^{th}-degree polynomial exponent sequence.

[00140] For example, the D^{th}-degree polynomial exponent sequence is a fourth-degree polynomial exponent sequence, and the first coefficient may be any one of the following:

a coefficient of a third-degree term or a coefficient of a second-degree term.

[00141] Correspondingly, a coefficient of a fourth-degree term of the fourth-degree polynomial exponent sequence is correlated with the coefficient of the third-degree term or the coefficient of the second-degree term.

[00142] For example, the D^{th}-degree polynomial exponent sequence is a fifth-degree polynomial exponent sequence, and the first coefficient may be any one of the following:

a coefficient of a fourth-degree term, a coefficient of a third-degree term, or a coefficient of a second-degree term.

[00143] Correspondingly, a coefficient of a fifth-degree term of the fifth-degree polynomial exponent sequence is correlated with the coefficient of the fourth-degree term, the coefficient of the third-degree term, or the coefficient of the second-degree term.

[00144] In this embodiment of this application, that the first coefficient is correlated with the coefficient of the highest-degree term includes but is not limited to: a value of the coefficient of the highest-degree term is correlated with a value of the first coefficient, or a value range of the first coefficient is correlated with a value range of the coefficient of the highest-degree term.

[00145] For example, the value of the coefficient of the highest-degree term of the D^{th}-degree

polynomial exponent sequence is T, the value of the first coefficient of the D^{th}-degree polynomial exponent sequence is $T \cdot U$, and both T and U are positive integers. In this way, the value of the first coefficient is correlated with the value of the coefficient of the highest-degree term.

[00146] For example, the value range of the coefficient of the highest-degree term of the D^{th}-degree polynomial exponent sequence is $\{1,2,\dots,T\}$, the value range of the first coefficient of the D^{th}-degree polynomial exponent sequence is $\{U, 2 \cdot U, \dots, T \cdot U\}$, and both T and U are positive integers. In this way, the value range of the first coefficient is correlated with the value range of the coefficient of the highest-degree term.

[00147] Coefficients of some terms of the D^{th}-degree polynomial exponent sequence are correlated with each other, for example, the coefficient of the highest-degree term is correlated with the first coefficient. This helps avoid peak values in any two polynomial exponent sequences within a specific range, to help distinguish between different sequences, thereby reducing strong interference between different sequences, and improving communication performance.

[00148] In a possible implementation, the first coefficient of the D^{th}-degree polynomial exponent sequence is correlated with a first parameter, and the first parameter is one of a maximum delay spread and a maximum Doppler spread.

[00149] For example, the first parameter is the maximum delay spread, and the first coefficient is correlated with the maximum delay spread.

[00150] For example, the first parameter is the maximum Doppler spread, and the first coefficient is correlated with the maximum Doppler spread.

[00151] That the first coefficient is correlated with the first parameter includes but is not limited to: the value of the first coefficient includes the first parameter, or the value range of the first coefficient is correlated with a value range of the first parameter.

[00152] For example, the maximum delay spread may be represented as Δ_{T}, and the value of the first coefficient is $T \cdot U \cdot \Delta_{\text{T}}$.

[00153] For example, the maximum Doppler spread may be represented as Δ_{F}, and the value of the first coefficient is $T \cdot U \cdot \Delta_{\text{F}}$.

[00154] The first coefficient is correlated with the first parameter. In this way, a correlation function of any two polynomial exponent sequences does not exceed a threshold within a specific range of a domain in which the first parameter is located, thereby improving communication performance.

[00155] In a possible implementation, a coefficient of a first-degree term of the D^{th}-degree polynomial exponent sequence is correlated with a second parameter, the second parameter is one of the maximum Doppler spread and the maximum delay spread, and the first parameter is different

from the second parameter.

[00156] For example, the first parameter is the maximum delay spread, and the second parameter is the maximum Doppler spread. In this way, the coefficient of the first-degree term is correlated with the maximum Doppler spread.

[00157] For example, the first parameter is the maximum Doppler spread, and the second parameter is the maximum delay spread. In this way, the coefficient of the first-degree term is correlated with the maximum delay spread.

[00158] The coefficient of the first-degree term is correlated with the second parameter. In this way, a correlation function of any two polynomial exponent sequences is equal to 0 within a specific range of a domain in which the second parameter is located, thereby improving communication performance.

[00159] In a possible implementation, an expression of the D^{th}-degree polynomial exponent sequence is as follows:

$$s_{a_D,a_{D-1},\dots,a_1,a_0}(n) = e^{-j2\pi(a_D n^D + a_{D-1} n^{D-1} + \cdots + a_1 n + a_0)/N} \quad (9), \text{ where } n = 0,1,\dots,N-1.$$

[00160] In the formula (9), a_D is the coefficient of the highest-degree term, a_{D-1} is the coefficient of the second-highest-degree term, a_1 is the coefficient of the first-degree term, and a_0 is a constant term. "..." represents coefficients of terms other than the coefficient of the second-highest-degree term and the coefficient of the first-degree term. The first coefficient is any one of coefficients from a_{D-1} to a_2, N is a sequence length, and N is a prime number.

[00161] The constant term a_0 in the formula (9) may be considered as rotating all symbols in the sequence $s_{a_D,a_{D-1},\dots,a_1,a_0}(n)$ by a common phase $e^{-j2\pi a_0/N}$. Because the phase rotation does not change the correlation and ambiguity of the sequence, without loss of generality, when $a_0 = 0$, the D^{th}-degree polynomial exponent sequence reduces to $s_{a_D,a_{D-1},\dots,a_1}(n) = e^{-j2\pi(a_D n^D + a_{D-1} n^{D-1} + \cdots + a_1 n)/N}$, where $n = 0,1,\dots,N-1$.

[00162] In addition, the constant term a_0 is used to perform phase rotation on the entire sequence, causing no change in a property of the sequence. Therefore, this application imposes no limitation on whether a listed polynomial exponent sequence includes a constant term.

[00163] According to the polynomial sequence, in this embodiment of this application, user requirements can be met.

[00164] In a possible embodiment, the D^{th}-degree polynomial exponent sequence includes a base sequence and an auxiliary sequence, or the D^{th}-degree polynomial exponent sequence is a sequence consisting of the base sequence and the auxiliary sequence. The base sequence meets a global unimodal feature, and the auxiliary sequence meets a large-capacity feature and a low-

ambiguity zone feature.

[00165] For example, the base sequence may be represented as follows:

$$u_{a_D}(n) = e^{-j2\pi a_D n^D/N} \quad (10).$$

[00166] For example, the auxiliary sequence may be represented as follows:

$$v_{a_{D-1},a_{D-2},\ldots,a_1}(n) = e^{-j2\pi(a_{D-1}n^{D-1}+a_{D-2}n^{D-2}+\cdots+a_1 n)/N} \quad (11).$$

[00167] In other words, the D^{th}-degree polynomial exponent sequence may be represented as $s_{a_D,a_{D-1},\ldots,a_1}(n) = u_{a_D}(n) \cdot v_{a_{D-1},a_{D-2},\ldots,a_1}(n)$. In other words, the D^{th}-degree polynomial exponent sequence may be represented as a form of element-wise multiplication of the base sequence and the auxiliary sequence. Sequence lengths of the base sequence and the auxiliary sequence are both N.

[00168] For example, if the base sequence is $\left[u_{a_D}(0), u_{a_D}(1), \ldots, u_{a_D}(N-1)\right]$, and the auxiliary sequence is $\left[v_{a_{D-1},a_{D-2},\ldots,a_1}(0), v_{a_{D-1},a_{D-2},\ldots,a_1}(1), \ldots, v_{a_{D-1},a_{D-2},\ldots,a_1}(N-1)\right]$, a result of element-wise multiplication of the base sequence and the auxiliary sequence is $\left[u_{a_D}(0) \cdot v_{a_{D-1},a_{D-2},\ldots,a_1}(0), u_{a_D}(1) \cdot v_{a_{D-1},a_{D-2},\ldots,a_1}(1), \ldots, u_{a_D}(N-1) \cdot v_{a_{D-1},a_{D-2},\ldots,a_1}(N-1)\right]$.

[00169] In this embodiment of this application, the base sequence is a sequence correlated with a cell. For example, a same cell corresponds to a same base sequence, and different cells correspond to different base sequences. Alternatively, a same cell corresponds to a plurality of base sequences, and different cells correspond to different base sequences. The auxiliary sequence is a sequence correlated with a terminal device in the cell. For example, different terminal devices in a same cell correspond to different auxiliary sequences.

[00170] The D^{th}-degree polynomial exponent sequence is constructed based on the base sequence and the auxiliary sequence. This can distinguish between different cells, and can also distinguish between different terminal devices.

[00171] In this embodiment of this application, the base sequence needs to meet the following conditions: An auto-ambiguity function of the base sequence has a unimodal feature on a delay-Doppler plane, and a cross-ambiguity function of the base sequence has no peak value on the delay-Doppler plane.

[00172] In a possible implementation, the first coefficient of the D^{th}-degree polynomial exponent sequence is the coefficient of the second-highest-degree term of the D^{th}-degree polynomial exponent sequence. In this way, an ambiguity function of any two polynomial exponent sequences within a range of the maximum delay spread and the maximum Doppler spread is less than a threshold.

[00173] In a possible implementation, when the polynomial exponent sequence is mapped by

using a time domain resource, the first parameter is the maximum delay spread, and the second parameter is the maximum Doppler spread.

[00174] In this way, the first coefficient is correlated with the maximum delay spread, and the coefficient of the first-degree term is correlated with the maximum Doppler spread. This helps implement a low-ambiguity zone feature, that is, an ambiguity function of any two polynomial exponent sequences within a range of the maximum delay spread and the maximum Doppler spread does not exceed a threshold.

[00175] In a possible implementation, when the polynomial exponent sequence is mapped by using a frequency domain resource, the first parameter is the maximum Doppler spread, and the second parameter is the maximum delay spread.

[00176] In this way, the first coefficient is correlated with the maximum Doppler spread, and the coefficient of the first-degree term is correlated with the maximum delay spread. This helps implement a low-ambiguity zone feature, that is, an ambiguity function of any two polynomial exponent sequences within a range of the maximum delay spread and the maximum Doppler spread does not exceed a threshold.

[00177] In S202, the first apparatus sends (or outputs or transmits) the polynomial exponent sequence.

[00178] Correspondingly, a second apparatus receives the polynomial exponent sequence.

[00179] A manner in which the first apparatus sends the polynomial exponent sequence is correlated with a form of the first apparatus and a form of the second apparatus.

[00180] For example, the first apparatus and the second apparatus are deployed in a same device. For example, the first apparatus and the second apparatus are both included in a terminal device, or the first apparatus and the second apparatus are both included in a network device. In this case, "outputting" from the first apparatus to the second apparatus belongs to an internal operation.

[00181] For example, the first apparatus and the second apparatus are deployed in different devices. For example, the first apparatus may be an apparatus in a terminal device (or a terminal device), and the second apparatus may be an apparatus in a network device (or a network device). In this case, "outputting" from the first apparatus to the second apparatus may be understood as "sending" from the first apparatus to the second apparatus. Alternatively, the first apparatus and the second apparatus are separately deployed in terminal devices. For example, the first apparatus is deployed in a first terminal device, and the second apparatus is deployed in a second terminal device.

[00182] When the first apparatus and the second apparatus are deployed in different devices, a manner in which the first apparatus "sends the polynomial exponent sequence" to the second apparatus may include the following two manners.

[00183] Manner 1:

[00184] The first apparatus maps the D^{th}-degree polynomial exponent sequence to the time domain resource, and a discrete-time signal of the D^{th}-degree polynomial exponent sequence is represented as follows:

$$\bar{s}_{\lambda_D,\lambda_{D-1},\dots,\lambda_1}(n) = e^{-j2\pi(\lambda_D n^D + D\lambda_D\lambda_{D-1}\Delta_T n^{D-1} + \lambda_{D-2}n^{D-2} + \cdots + \lambda_2 n^2 + \lambda_1\Delta_F n)/N} \quad (12).$$

[00185] $\lambda_D \in \{1,2,\dots,N-1\}, \lambda_{D-1} \in \{0,1,\dots,\lfloor N/\Delta_T \rfloor - 1\}, \lambda_{D-2},\dots,\lambda_2 \in \{0,1,\dots,N-1\}, \lambda_1 \in \{0,1,\dots,\lfloor N/\Delta_F \rfloor - 1\}$. $\Delta_T \times \Delta_F$ represents an ambiguity zone. "..." indicates that a value assignment rule of an unshown parameter is the same as a value assignment rule of a shown parameter. For example, $\lambda_{D-3} \in \{0,1,\dots,N-1\}$.

[00186] It may be learned that a coefficient of a D^{th}-degree term is correlated with a coefficient of a $(D-1)^{\text{th}}$-degree term, the coefficient of the $(D-1)^{\text{th}}$-degree term is correlated with Δ_T, and the coefficient of the first-degree term is correlated with Δ_F.

[00187] It may be learned that sequence capacity of the D^{th}-degree polynomial exponent sequence is positively correlated with N^D, that is, $(N-1)\cdot\lfloor N/\Delta_T \rfloor \cdot N^{D-3} \cdot \lfloor N/\Delta_F \rfloor$. $\lfloor\cdot\rfloor$ represents rounding down. Compared with an existing sequence that is a second-degree polynomial exponent sequence, the D^{th}-degree polynomial exponent sequence can meet a requirement for high sequence capacity.

[00188] When the first coefficient of the D^{th}-degree polynomial exponent sequence is correlated with Δ_T, and the coefficient of the first-degree term is correlated with Δ_F, the D^{th}-degree polynomial exponent sequence can meet a low-ambiguity zone feature.

[00189] Specifically, when two D^{th}-degree polynomial exponent sequences, for example, $s_{\lambda_D,\lambda_{D-1},\dots,\lambda_1}(n)$ and $s_{\mu_D,\mu_{D-1},\dots,\mu_1}(n)$, are separately mapped by using time domain resources, a cross-ambiguity function of the two D^{th}-degree polynomial exponent sequences may be represented as follows:

$$\left|A_{s_{\lambda_D,\lambda_{D-1},\dots,\lambda_1},s_{\mu_D,\mu_{D-1},\dots,\mu_1}}(\tau,\nu)\right| = \begin{cases} N & \lambda_D=\mu_D,\dots,\lambda_1=\mu_1,\tau=0,\nu=0 \\ 0 & \lambda_D=\mu_D,\dots,\lambda_2=\mu_2,\tau=0,(\lambda_1\neq\mu_1)\vee(\nu\neq 0) \\ \sqrt{N} & \lambda_D=\mu_D,\dots,\lambda_3=\mu_3,\tau=0,\lambda_2\neq\mu_2 \\ \leq (d-1)\sqrt{N} & \lambda_D=\mu_D,\dots,\lambda_{d+1}=\mu_{d+1},\tau=0,\lambda_d\neq\mu_d \\ \leq (D-2)\sqrt{N} & \lambda_D=\mu_D,(\lambda_{D-1}\neq\mu_{D-1})\vee(\tau\neq 0) \\ \leq (D-1)\sqrt{N} & \lambda_D\neq\mu_D \end{cases} \quad (13).$$

[00190] In the formula (13), $\tau \in [0,\Delta_T-1], \nu \in [0,\Delta_F-1]$. $d = 3,4,\dots,D-2$.

[00191] When $\lambda_D=\mu_D,\dots,\lambda_1=\mu_1,\tau=0,\nu=0$, the D^{th}-degree polynomial exponent sequence can meet a global unimodal feature, that is, only a value of an ambiguity function of the D^{th}-degree polynomial exponent sequence at an origin is N, and other values are all less than N.

[00192] When $\lambda_D=\mu_D,\dots,\lambda_2=\mu_2,\tau=0,(\lambda_1\neq\mu_1)\vee(\nu\neq 0)$, the D^{th}-degree polynomial exponent sequence can meet a Doppler-domain zero-correlation zone feature.

[00193] When $\lambda_D = \mu_D, \ldots, \lambda_3 = \mu_3, \tau = 0, \lambda_2 \neq \mu_2$, the D^{th}-degree polynomial exponent sequence can meet a low-ambiguity zone feature.

[00194] When $\lambda_D = \mu_D, \ldots, \lambda_{d+1} = \mu_{d+1}, \tau = 0, \lambda_d \neq \mu_d$, the D^{th}-degree polynomial exponent sequence can meet a low-ambiguity zone feature.

[00195] When $\lambda_D = \mu_D, (\lambda_{D-1} \neq \mu_{D-1}) \vee (\tau \neq 0)$, the D^{th}-degree polynomial exponent sequence can meet a low-ambiguity zone feature.

[00196] When $\lambda_D \neq \mu_D$, the D^{th}-degree polynomial exponent sequence can meet a low-ambiguity zone feature.

[00197] It may be learned from the formula (13) that a maximum value of the ambiguity function of the D^{th}-degree polynomial exponent sequence does not exceed $(D-1)\sqrt{N}$. In this way, the D^{th}-degree polynomial exponent sequence can meet the low-ambiguity zone feature.

[00198] Because the D^{th}-degree polynomial exponent sequence is a constant modulus sequence, mapping the D^{th}-degree polynomial exponent sequence to the time domain resource can reduce a peak-to-average power ratio.

[00199] Further, for example, $D = 4$, and the first apparatus maps a fourth-degree polynomial exponent sequence to a time domain resource, and a discrete-time signal of the fourth-degree polynomial exponent sequence is represented as follows:

$$\bar{s}_{\lambda,\mu,k,l}(n) = e^{-j2\pi(\lambda n^4 + 4\lambda\mu\Delta_{\mathrm{T}} n^3 + kn^2 + l\Delta_{\mathrm{F}} n)/N} \quad (14).$$

[00200] $\lambda \in \{1,2,\ldots,N-1\}, \mu \in \{0,1,\ldots,\lfloor N/\Delta_{\mathrm{T}} \rfloor - 1\}, k \in \{0,1,\ldots,N-1\}, l \in \{0,1,\ldots,\lfloor N/\Delta_{\mathrm{F}} \rfloor - 1\}$. $\lambda = \lambda_4$, $\mu = \lambda_3$, $k = \lambda_2$, and $l = \lambda_1$.

[00201] It may be learned from the formula (14) that a coefficient of a fourth-degree term is correlated with a coefficient of a third-degree term, the coefficient of the third-degree term is correlated with Δ_{T}, and a coefficient of a first-degree term is correlated with Δ_{F}.

[00202] Sequence capacity of the fourth-degree polynomial exponent sequence is positively correlated with a sequence length, of the fourth-degree polynomial exponent sequence, raised to the power of 4, that is, $(N-1) \cdot \lfloor N/\Delta_{\mathrm{T}} \rfloor \cdot N \cdot \lfloor N/\Delta_{\mathrm{F}} \rfloor$.

[00203] When a first coefficient of the fourth-degree polynomial exponent sequence is correlated with Δ_{T}, and the coefficient of the first-degree term is correlated with Δ_{F}, the fourth-degree polynomial exponent sequence can meet a low-ambiguity zone feature.

[00204] Specifically, when two fourth-degree polynomial exponent sequences, for example, $s_{\lambda_1,\mu_1,k_1,l_1}(n)$ and $s_{\lambda_2,\mu_2,k_2,l_2}(n)$, are separately mapped by using time domain resources, a cross-ambiguity function of the two fourth-degree polynomial sequences is represented as follows:

$$\left|A_{s_{\lambda_1,\mu_1,k_1,l_1},s_{\lambda_2,\mu_2,k_2,l_2}}(\tau,\nu)\right| = \begin{cases} N & \lambda_1=\lambda_2,\mu_1=\mu_2,k_1=k_2,l_1=l_2,\tau=0,\nu=0 \\ 0 & \lambda_1=\lambda_2,\mu_1=\mu_2,k_1=k_2,\tau=0,(l_1\neq l_2)\vee(\nu\neq 0) \\ \sqrt{N} & \lambda_1=\lambda_2,\mu_1=\mu_2,\tau=0,k_1\neq k_2 \\ \leq 2\sqrt{N} & \lambda_1=\lambda_2,(\mu_1\neq\mu_2)\vee(\tau\neq 0) \\ \leq 3\sqrt{N} & \lambda_1\neq\lambda_2 \end{cases} \quad (15).$$

[00205] In the formula (15), $\tau \in [0, \Delta_T - 1], \nu \in [0, \Delta_F - 1]$.

[00206] When $\lambda_1 = \lambda_2, \mu_1 = \mu_2, k_1 = k_2, l_1 = l_2, \tau = 0, \nu = 0$, the fourth-degree polynomial exponent sequence can meet a global unimodal feature.

[00207] When $\lambda_1 = \lambda_2, \mu_1 = \mu_2, k_1 = k_2, \tau = 0, (l_1 \neq l_2) \vee (\nu \neq 0)$, the fourth-degree polynomial exponent sequence can meet a Doppler-domain zero-correlation zone feature.

[00208] When $\lambda_D = \mu_D, \ldots, \lambda_3 = \mu_3, \tau = 0, \lambda_2 \neq \mu_2$, the fourth-degree polynomial exponent sequence can meet a low-ambiguity zone feature.

[00209] When $\lambda_1 = \lambda_2, \mu_1 = \mu_2, \tau = 0, k_1 \neq k_2$, the fourth-degree polynomial exponent sequence can meet a low-ambiguity zone feature.

[00210] When $\lambda_1 = \lambda_2, (\mu_1 \neq \mu_2) \vee (\tau \neq 0)$, the fourth-degree polynomial exponent sequence can meet a low-ambiguity zone feature.

[00211] When $\lambda_1 \neq \lambda_2$, the fourth-degree polynomial exponent sequence can meet a low-ambiguity zone feature.

[00212] It may be learned from the formula (15) that a maximum value of an ambiguity function of the fourth-degree polynomial exponent sequence does not exceed $3\sqrt{N}$. In this way, the fourth-degree polynomial exponent sequence can meet the low-ambiguity zone feature.

[00213] Because the fourth-degree polynomial exponent sequence is a constant modulus sequence, mapping the fourth-degree polynomial exponent sequence to the time domain resource can reduce a peak-to-average power ratio.

[00214] Manner 2:

[00215] The first apparatus maps the D^{th}-degree polynomial exponent sequence to the frequency domain resource, and a discrete-time signal of the D^{th}-degree polynomial exponent sequence is represented as follows:

$$\bar{s}_{\lambda_D,\lambda_{D-1},\ldots,\lambda_1}(n) = \frac{1}{\sqrt{N}}\sum_{m=0}^{N-1} e^{-j2\pi(\lambda_D m^D + D\lambda_D\lambda_{D-1}\Delta_F m^{D-1} + \lambda_{D-2}m^{D-2} + \cdots + \lambda_2 m^2 + \lambda_1\Delta_T m)/N} \cdot e^{j2\pi mn/N} \quad (16).$$

[00216] $\lambda_D \in \{1,2,\ldots,N-1\}, \lambda_{D-1} \in \{0,1,\ldots,\lfloor N/\Delta_F \rfloor - 1\}, \lambda_{D-2}, \ldots, \lambda_2 \in \{0,1,\ldots,N-1\}, \lambda_1 \in \{0,1,\ldots,\lfloor N/\Delta_T \rfloor - 1\}$. $\Delta_T \times \Delta_F$ represents an ambiguity zone. "..." indicates that a value assignment rule of an unshown parameter is the same as a value assignment rule of a shown parameter. For example, $\lambda_{D-3} \in \{0,1,\ldots,N-1\}$.

[00217] It may be learned that a coefficient of a D^{th}-degree term is correlated with a coefficient of a $(D-1)^{\text{th}}$-degree term, the coefficient of the $(D-1)^{\text{th}}$-degree term is correlated with Δ_F, and

the coefficient of the first-degree term is correlated with Δ_T.

[00218] It may be learned that sequence capacity of the D^{th}-degree polynomial exponent sequence is positively correlated with N^D, that is, $(N-1)\cdot\lfloor N/\Delta_F\rfloor\cdot N^{D-3}\cdot\lfloor N/\Delta_T\rfloor$. Compared with a second-degree polynomial exponent sequence, the D^{th}-degree polynomial exponent sequence can meet a requirement for high sequence capacity.

[00219] When the first coefficient of the D^{th}-degree polynomial exponent sequence is correlated with Δ_F, and the coefficient of the first-degree term is correlated with Δ_T, the D^{th}-degree polynomial exponent sequence can meet a low-ambiguity zone feature.

[00220] Specifically, when two D^{th}-degree polynomial exponent sequences, for example, $s_{\lambda_D,\lambda_{D-1},\dots,\lambda_1}(n)$ and $s_{\mu_D,\mu_{D-1},\dots,\mu_1}(n)$, are separately mapped by using frequency domain resources, a cross-ambiguity function of the two D^{th}-degree polynomial exponent sequences may be represented as follows:

$$\left|A_{s_{\lambda_D,\lambda_{D-1},\dots,\lambda_1},s_{\mu_D,\mu_{D-1},\dots,\mu_1}}(\tau,\nu)\right|=\begin{cases}N & \lambda_D=\mu_D,\dots,\lambda_1=\mu_1,\tau=0,\nu=0\\ 0 & \lambda_D=\mu_D,\dots,\lambda_2=\mu_2,\nu=0,(\lambda_1\neq\mu_1)\vee(\tau\neq0)\\ \sqrt{N} & \lambda_D=\mu_D,\dots,\lambda_3=\mu_3,\nu=0,\lambda_2\neq\mu_2\\ \leq(d-1)\sqrt{N} & \lambda_D=\mu_D,\dots,\lambda_{d+1}=\mu_{d+1},\nu=0,\lambda_d\neq\mu_d\\ \leq(D-2)\sqrt{N} & \lambda_D=\mu_D,(\lambda_{D-1}\neq\mu_{D-1})\vee(\nu\neq0)\\ \leq(D-1)\sqrt{N} & \lambda_D\neq\mu_D\end{cases}\quad(17).$$

[00221] In the formula (17), $\tau\in[0,\Delta_T-1],\nu\in[0,\Delta_F-1]$. $d=3,4,\dots,D-2$.

[00222] When $\lambda_D=\mu_D,\dots,\lambda_1=\mu_1,\tau=0,\nu=0$, the D^{th}-degree polynomial exponent sequence can meet a global unimodal feature.

[00223] When $\lambda_D=\mu_D,\dots,\lambda_2=\mu_2,\tau=0,(\lambda_1\neq\mu_1)\vee(\nu\neq0)$, the D^{th}-degree polynomial exponent sequence can meet a delay-domain zero-correlation zone feature.

[00224] When $\lambda_D=\mu_D,\dots,\lambda_3=\mu_3,\tau=0,\lambda_2\neq\mu_2$, the D^{th}-degree polynomial exponent sequence can meet a low-ambiguity zone feature.

[00225] When $\lambda_D=\mu_D,\dots,\lambda_{d+1}=\mu_{d+1},\tau=0,\lambda_d\neq\mu_d$, the D^{th}-degree polynomial exponent sequence can meet a low-ambiguity zone feature.

[00226] When $\lambda_D=\mu_D,(\lambda_{D-1}\neq\mu_{D-1})\vee(\tau\neq0)$, the D^{th}-degree polynomial exponent sequence can meet a low-ambiguity zone feature.

[00227] When $\lambda_D\neq\mu_D$, the D^{th}-degree polynomial exponent sequence can meet a low-ambiguity zone feature.

[00228] It may be learned from the formula (17) that a maximum value of an ambiguity function of the D^{th}-degree polynomial exponent sequence does not exceed $(D-1)\sqrt{N}$. In this way, the D^{th}-degree polynomial exponent sequence can meet the low-ambiguity zone feature.

[00229] Because the D^{th}-degree polynomial exponent sequence is a constant modulus sequence, mapping the D^{th}-degree polynomial exponent sequence to the frequency domain resource can meet

the zero-correlation zone feature. Specifically, because the D^{th}-degree polynomial exponent sequence is a constant modulus sequence, according to the Wiener-Khinchin theorem, frequency domain resource mapping of the constant modulus sequence achieves an ideal time domain auto-correlation feature. Therefore, a zero-correlation zone may be constructed by mapping the D^{th}-degree polynomial exponent sequence to the frequency domain resource.

[00230] In this embodiment of this application, the constant modulus sequence may be understood as a phase coding sequence with a constant amplitude. The constant modulus sequence may also be referred to as a constant amplitude sequence or a constant envelope sequence.

[00231] Further, for example, $D = 4$, and the first apparatus may map a fourth-degree polynomial exponent sequence to a frequency domain resource, and a discrete-time signal of the fourth-degree polynomial exponent sequence is represented as follows:

$$\bar{s}_{\lambda,\mu,k,l}(n) = \frac{1}{\sqrt{N}} \sum_{m=0}^{N-1} e^{-j2\pi\left(\lambda m^4 + 4\lambda\mu\Delta_{\text{F}} m^3 + km^2 + l\Delta_{\text{T}} m\right)/N} \cdot e^{j2\pi mn/N} \quad (18).$$

[00232] $\lambda \in \{1,2,\dots,N-1\}, \mu \in \{0,1,\dots,\lfloor N/\Delta_{\text{F}} \rfloor - 1\}, k \in \{0,1,\dots,N-1\}, l \in \{0,1,\dots,\lfloor N/\Delta_{\text{T}} \rfloor - 1\}$. $\lambda = \lambda_4$, $\mu = \lambda_3$, $k = \lambda_2$, and $l = \lambda_1$.

[00233] It may be learned that, in the fourth-degree polynomial exponent sequence, a coefficient of a fourth-degree term is correlated with a coefficient of a third-degree term, the coefficient of the third-degree term is correlated with the maximum delay spread, and a coefficient of a first-degree term is correlated with the maximum Doppler spread.

[00234] It may be learned that sequence capacity of the fourth-degree polynomial exponent sequence is positively correlated with N^4, that is, $(N-1) \cdot \lfloor N/\Delta_{\text{F}} \rfloor \cdot N \cdot \lfloor N/\Delta_{\text{T}} \rfloor$. In this way, compared with an existing sequence that is a second-degree polynomial exponent sequence, the D^{th}-degree polynomial exponent sequence in this embodiment of this application can meet a requirement for high sequence capacity.

[00235] When a first coefficient of the fourth-degree polynomial exponent sequence is correlated with Δ_{F}, and the coefficient of the first-degree term is correlated with Δ_{T}, the fourth-degree polynomial exponent sequence can meet a low-ambiguity zone feature.

[00236] Specifically, when two fourth-degree polynomial exponent sequences, for example, $s_{\lambda_1,\mu_1,k_1,l_1}(n)$ and $s_{\lambda_2,\mu_2,k_2,l_2}(n)$, are separately mapped by using frequency domain resources, a cross-ambiguity function of the two fourth-degree polynomial exponent sequences may be represented as follows:

$$\left|A_{s_{\lambda_1,\mu_1,k_1,l_1},s_{\lambda_2,\mu_2,k_2,l_2}}(\tau,\nu)\right| = \begin{cases} N & \lambda_1 = \lambda_2, \mu_1 = \mu_2, k_1 = k_2, l_1 = l_2, \tau = 0, \nu = 0 \\ 0 & \lambda_1 = \lambda_2, \mu_1 = \mu_2, k_1 = k_2, \nu = 0, (l_1 \neq l_2) \vee (\tau \neq 0) \\ \sqrt{N} & \lambda_1 = \lambda_2, \mu_1 = \mu_2, \nu = 0, k_1 \neq k_2 \\ \leq 2\sqrt{N} & \lambda_1 = \lambda_2, (\mu_1 \neq \mu_2) \vee (\nu \neq 0) \\ \leq 3\sqrt{N} & \lambda_1 \neq \lambda_2 \end{cases} \quad (19).$$

[00237] In the formula (19), $\tau \in [0, \Delta_T - 1], \nu \in [0, \Delta_F - 1]$.

[00238] When $\lambda_1 = \lambda_2, \mu_1 = \mu_2, k_1 = k_2, l_1 = l_2, \tau = 0, \nu = 0$, the fourth-degree polynomial exponent sequence can meet a global unimodal feature.

[00239] When $\lambda_1 = \lambda_2, \mu_1 = \mu_2, k_1 = k_2, \tau = 0, (l_1 \neq l_2) \vee (\nu \neq 0)$, the fourth-degree polynomial exponent sequence can meet a delay-domain zero-correlation zone feature.

[00240] When $\lambda_D = \mu_D, \ldots, \lambda_3 = \mu_3, \tau = 0, \lambda_2 \neq \mu_2$, the fourth-degree polynomial exponent sequence can meet a low-ambiguity zone feature.

[00241] When $\lambda_1 = \lambda_2, \mu_1 = \mu_2, \tau = 0, k_1 \neq k_2$, the fourth-degree polynomial exponent sequence can meet a low-ambiguity zone feature.

[00242] When $\lambda_1 = \lambda_2, (\mu_1 \neq \mu_2) \vee (\tau \neq 0)$, the fourth-degree polynomial exponent sequence can meet a low-ambiguity zone feature.

[00243] When $\lambda_1 \neq \lambda_2$, the fourth-degree polynomial exponent sequence can meet a low-ambiguity zone feature.

[00244] It may be learned from the formula (19) that a maximum value of an ambiguity function of the fourth-degree polynomial exponent sequence does not exceed $3\sqrt{N}$. In this way, the fourth-degree polynomial exponent sequence can meet the low-ambiguity zone feature.

[00245] Because the fourth-degree polynomial exponent sequence is a constant modulus sequence, mapping the fourth-degree polynomial exponent sequence to the frequency domain resource can meet the zero-correlation zone feature.

[00246] After the second apparatus receives the polynomial exponent sequence, the second apparatus needs to process the polynomial exponent sequence. A manner in which the second apparatus processes the polynomial exponent sequence is correlated with the form of the first apparatus and the form of the second apparatus.

[00247] For example, the first apparatus and the second apparatus are deployed in a terminal device, and the second apparatus may process the polynomial exponent sequence. For example, the second apparatus generates a signal based on the polynomial exponent sequence, and sends the signal to a receiver.

[00248] For example, the first apparatus and the second apparatus are deployed in a network device, and the second apparatus may process the polynomial exponent sequence. For example, the second apparatus generates a signal based on the polynomial exponent sequence, and sends the signal to a receiver.

[00249] For example, the first apparatus is deployed in a terminal device, the second apparatus is deployed in a network device, and the second apparatus may process the polynomial exponent sequence. For example, when the polynomial exponent sequence is used for a physical random

access channel, the second apparatus performs correlation processing and matched filtering on the polynomial exponent sequence, to determine a random access preamble and a round trip delay and/or a Doppler frequency shift. For another example, when the polynomial exponent sequence is used for a DMRS, the second apparatus performs correlation processing and matched filtering on the polynomial exponent sequence, to perform channel estimation.

[00250] In this embodiment of this application, when the first apparatus and the second apparatus are separately deployed in different devices, a manner in which the first apparatus sends the polynomial exponent sequence to the second apparatus may include:

the first apparatus determines indication information, where the indication information indicates the polynomial exponent sequence.

[00251] For example, the first apparatus may configure an index for each polynomial exponent sequence, where a correspondence between each polynomial exponent sequence and the index may be configured in a protocol pre-configuration manner; and the second apparatus may determine the correspondence between each polynomial exponent sequence and the corresponding index based on a protocol. In this way, the first apparatus may send the indication information to the second apparatus, and the second apparatus may determine the polynomial exponent sequence based on the indication information.

[00252] For another example, the indication information may include one or more coefficients of the polynomial exponent sequence. In this way, the second apparatus may determine the polynomial exponent sequence based on the one or more coefficients carried in the indication information.

[00253] For example, when the indication information may include all coefficients of the polynomial exponent sequence, the second apparatus may determine the polynomial exponent sequence based on all the coefficients.

[00254] For example, when the indication information may include some coefficients of the polynomial exponent sequence, and remaining coefficients may be configured in a protocol configuration manner, the second apparatus may determine the polynomial exponent sequence based on content preconfigured in a protocol and some coefficients.

[00255] In conclusion, a manner in which the first apparatus indicates the polynomial exponent sequence to the second apparatus is not limited in this embodiment of this application.

[00256] It should be noted that the polynomial exponent sequence may have a plurality of purposes. As a case, the polynomial exponent sequence may be used in a random access process of a terminal device. A specific process is not described.

[00257] Finally, apparatus embodiments in embodiments of this application are described.

[00258] To implement the functions in the method provided in this application, the first

apparatus and the second apparatus each may include a hardware structure and/or a software module, and the foregoing functions are implemented in a form of the hardware structure, the software module, or a combination of the hardware structure and the software module. Whether a function in the foregoing functions is performed by the hardware structure, the software module, or the combination of the hardware structure and the software module depends on particular applications and design constraints of the technical solutions.

[00259] FIG. 3 is a block diagram of a communication apparatus according to an embodiment of this application. The communication apparatus includes a processing circuit 310 and a transceiver circuit 320. The processing circuit 310 and the transceiver circuit 320 may be connected or coupled to each other, for example, connected to each other via a bus 330. The communication apparatus may be a first apparatus or a second apparatus.

[00260] Optionally, the communication apparatus may further include a memory 340. The memory 340 includes but is not limited to a random access memory (random access memory, RAM), a read-only memory (read-only memory, ROM), an erasable programmable read-only memory (erasable programmable read-only memory, EPROM), or a compact disc read-only memory (compact disc read-only memory, CD-ROM). The memory 340 is configured to store related instructions and data.

[00261] The processing circuit 310 may be all or some processing circuits in one or more processors, or may be one or more processors. The processor may be a central processing unit (central processing unit, CPU). When the processing circuit 310 is one CPU, the CPU may be a single-core CPU, or may be a multi-core CPU. The processing circuit 310 may be a signal processor, a chip, or another integrated circuit that can implement the method in this application, or some circuits, in the processor, the chip, or the integrated circuit, configured to perform a processing function. In addition, the transceiver circuit 320 may alternatively be a transceiver or an input/output interface. The input/output interface is configured to input or output a signal or data, and may also be referred to as an input/output circuit.

[00262] The communication apparatus shown in FIG. 3 can be configured to perform the method in the foregoing method embodiment.

[00263] For example, the apparatus shown in FIG. 3 is a first apparatus, and the first apparatus is configured to perform the method related to the first apparatus in the foregoing method embodiment.

[00264] For example, the processing circuit 310 is configured to determine the polynomial exponent sequence, and the transceiver circuit 320 is configured to send the polynomial exponent sequence to a second apparatus. For descriptions of the polynomial exponent sequence, refer to the foregoing descriptions. Details are not described again.

[00265] The processing circuit 310 may be further configured to determine the indication information in the foregoing method embodiment, and the transceiver circuit 320 may be further configured to send the indication information to the second apparatus. For descriptions of the indication information, refer to the foregoing descriptions. Details are not described again.

[00266] For example, the apparatus shown in FIG. 3 is a second apparatus, and the second apparatus is configured to perform the method related to the second apparatus in the foregoing method embodiment.

[00267] For example, the transceiver circuit 320 is configured to receive the polynomial exponent sequence from a first apparatus, and the processing circuit 310 is configured to process the polynomial exponent sequence. For descriptions about how to process the polynomial exponent sequence, refer to the foregoing descriptions. Details are not described again. For descriptions of the polynomial exponent sequence, refer to the foregoing descriptions. Details are not described again.

[00268] The transceiver circuit 320 may be further configured to receive the indication information in the foregoing method embodiment from the first apparatus, and the processing circuit 310 may be further configured to determine the polynomial indication sequence based on the indication information. For descriptions of the indication information, refer to the foregoing descriptions. Details are not described again.

[00269] The foregoing content is merely used as examples for description.

[00270] When the communication apparatus is the first apparatus or the second apparatus, the communication apparatus is responsible for performing the method or steps related to the first apparatus or the second apparatus in the foregoing method embodiment.

[00271] When the communication apparatus is the first apparatus or the second apparatus, the transceiver circuit 320 may be a transceiver. When the communication apparatus 300 is a chip used in the first apparatus or the second apparatus, the transceiver circuit 320 may be an input/output circuit. The foregoing descriptions are merely examples for description.

[00272] For specific content, refer to the content shown in the foregoing method embodiment.

[00273] For implementation of the operations in FIG. 3, further correspondingly refer to the corresponding descriptions in the method embodiment shown in FIG. 2.

[00274] FIG. 4 is a block diagram of another communication apparatus according to an embodiment of this application. The communication apparatus may be a first apparatus or a second apparatus, and is configured to implement the method in the foregoing embodiment.

[00275] The communication apparatus includes a transceiver unit 410 and a processing unit 420. The following describes the transceiver unit 410 and the processing unit 420.

[00276] The transceiver unit 410 may include a sending unit and a receiving unit. The sending

unit is configured to perform a sending action of the communication apparatus, and the receiving unit is configured to perform a receiving action of the communication apparatus. For ease of description, in this embodiment of this application, the sending unit and the receiving unit are combined into one transceiver unit. Unified descriptions are provided herein, and details are not described below again.

[00277] The communication apparatus shown in FIG. 4 can be configured to perform the method in the foregoing method embodiment.

[00278] For example, the apparatus shown in FIG. 4 is a first apparatus, and the first apparatus is configured to perform the method related to the first apparatus in the foregoing method embodiment.

[00279] For example, the processing unit 420 is configured to determine the polynomial exponent sequence, and the transceiver unit 410 is configured to send the polynomial exponent sequence to a second apparatus. For descriptions of the polynomial exponent sequence, refer to the foregoing descriptions. Details are not described again.

[00280] The processing unit 420 may be further configured to determine the indication information, and the transceiver unit 410 may be further configured to send the indication information to the second apparatus. For descriptions of the indication information, refer to the foregoing descriptions. Details are not described again.

[00281] For example, the apparatus shown in FIG. 4 is a second apparatus, and the second apparatus is configured to perform the method related to the second apparatus in the foregoing method embodiment.

[00282] For example, the transceiver unit 410 is configured to receive the polynomial exponent sequence from a first apparatus, and the processing unit 420 is configured to process the polynomial exponent sequence. For descriptions about how to process the polynomial exponent sequence, refer to the foregoing descriptions. Details are not described again. For descriptions of the polynomial exponent sequence, refer to the foregoing descriptions. Details are not described again.

[00283] The transceiver unit 410 may be further configured to receive the indication information in the foregoing method embodiment from the first apparatus, and the processing unit 420 may be further configured to determine the polynomial indication sequence based on the indication information. For descriptions of the indication information, refer to the foregoing descriptions. Details are not described again.

[00284] Optionally, the communication apparatus further includes a storage unit 430, and the storage unit 430 can be configured to store a program or code used to perform the foregoing method.

[00285] The transceiver unit in FIG. 4 may correspond to the transceiver circuit in FIG. 3, and the processing unit in FIG. 4 may correspond to the processing circuit in FIG. 3.

[00286] The apparatus embodiments shown in FIG. 3 and FIG. 4 are used to implement the content in FIG. 2. For specific execution steps and methods of the apparatuses shown in FIG. 3 and FIG. 4, refer to the content in the foregoing method embodiment.

[00287] This application further provides a chip, including a processor, configured to invoke instructions from a memory and run the instructions stored in the memory, to enable a communication device in which the chip is installed performs the methods in the foregoing examples. The memory may be integrated into the chip, or located outside the chip.

[00288] This application further provides another chip, including an input interface, an output interface, and a processing circuit. The input interface, the output interface, and the processing circuit are connected to each other via an internal connection path. The processing circuit is configured to execute code in a memory. When the code is executed, the processing circuit is configured to perform the methods in the foregoing examples. Optionally, the chip further includes the memory. The memory is configured to store a computer program or the code. The input interface and the output interface may be independent of each other, or may be integrated into an input/output interface.

[00289] The processing circuit may be all or some processing circuits in one or more processors, or may be one or more processors.

[00290] This application further provides a processor, configured to be coupled to a memory, and configured to perform the method and the function that are related to the network device or the terminal device in any one of the foregoing embodiments.

[00291] Another embodiment of this application provides a computer program product including instructions. When the computer program product is executed on a computer, the methods in the foregoing embodiments are implemented.

[00292] This application further provides a computer program. When the computer program is executed on a computer, the methods in the foregoing embodiments are implemented.

[00293] Another embodiment of this application provides a computer-readable storage medium. The computer-readable storage medium stores a computer program. When the computer program is executed on a computer, the methods in the foregoing embodiments are implemented.

[00294] It should be understood that the processor in embodiments of this application may be a central processing unit (central processing unit, CPU), or the processor may be another general-purpose processor, a digital signal processor (digital signal processor, DSP), an application-specific integrated circuit (application-specific integrated circuit, ASIC), a field programmable gate array (field programmable gate array, FPGA) or another programmable logic device, a

discrete gate or transistor logic device, a discrete hardware component, or the like. The general-purpose processor may be a microprocessor, or the processor may be any conventional processor or the like.

[00295] It may be further understood that the memory in embodiments of this application may be a volatile memory or a nonvolatile memory, or may include a volatile memory and a nonvolatile memory. The nonvolatile memory may be a read-only memory (read-only memory, ROM), a programmable read-only memory (programmable ROM, PROM), an erasable programmable read-only memory (erasable PROM, EPROM), an electrically erasable programmable read-only memory (electrically EPROM, EEPROM), or a flash memory. The volatile memory may be a random access memory (random access memory, RAM), and is used as an external cache. By way of example description and not limitative description, random access memories (random access memory, RAM) in many forms may be used, for example, a static random access memory (static RAM, SRAM), a dynamic random access memory (DRAM), a synchronous dynamic random access memory (synchronous DRAM, SDRAM), a double data rate synchronous dynamic random access memory (double data rate SDRAM, DDR SDRAM), an enhanced synchronous dynamic random access memory (enhanced SDRAM, ESDRAM), a synchlink dynamic random access memory (synchlink DRAM, SLDRAM), and a direct rambus random access memory (direct rambus RAM, DR RAM). It should be noted that the memory in the system and the method described in this specification is intended to include but is not limited to these memories or any memory of another proper type.

[00296] All or some of the foregoing embodiments may be implemented by software, hardware, firmware, or any combination thereof. When software is used to implement the foregoing embodiments, all or some of the foregoing embodiments may be implemented in a form of a computer program product. The computer program product includes one or more computer instructions or computer programs. When the program instructions or the computer programs are loaded and executed on a computer, all or some of the procedures or functions according to embodiments of this application are generated. The computer may be a general-purpose computer, a dedicated computer, a computer network, or another programmable apparatus. The computer instructions may be stored in a computer-readable storage medium or may be transmitted from a computer-readable storage medium to another computer-readable storage medium. For example, the computer instructions may be transmitted from a website, computer, server, or data center to another website, computer, server, or data center in a wired or wireless (for example, infrared, radio, or microwave) manner. The computer-readable storage medium may be any usable medium accessible by a computer, or a data storage device, such as a server or a data center, integrating one or more usable media. The usable medium may be a magnetic medium (for example, a floppy

disk, a hard disk, or a magnetic tape), an optical medium (for example, a DVD), or a semiconductor medium. The semiconductor medium may be a solid-state drive.

[00297] It should be understood that sequence numbers of the foregoing processes do not mean execution sequences in various embodiments of this application. The execution sequences of the processes should be determined based on functions and internal logic of the processes, and should not be understood as any limitation on the implementation processes of embodiments of this application.

[00298] A person of ordinary skill in the art may be aware that, in combination with the examples described in embodiments disclosed in this specification, units and algorithm steps can be implemented by electronic hardware or a combination of computer software and electronic hardware. Whether the functions are performed by hardware or software depends on particular applications and design constraints of the technical solutions. A person skilled in the art may use different methods to implement the described functions for each particular application, but it should not be considered that the implementation goes beyond the scope of this application. It may be clearly understood by a person skilled in the art that, for the purpose of convenient and brief description, for a detailed working process of the foregoing system, apparatus, and unit, refer to a corresponding process in the foregoing method embodiments. Details are not described herein again. In the several embodiments provided in this application, it should be understood that the disclosed system, apparatus, and method may be implemented in other manners. For example, the apparatus embodiments described above are merely examples. For example, division into the units is merely logical function division and there may be other division during actual implementation. For example, a plurality of units or components may be combined or may be integrated into another system, or some features may be ignored or not performed. In addition, the displayed or discussed mutual couplings or direct couplings or communication connections may be implemented via some interfaces. The indirect couplings or communication connections between the apparatuses or units may be implemented in electronic, mechanical, or other forms.

[00299] The units described as separate parts may or may not be physically separate, and the parts displayed as units may or may not be physical units, that is, may be located in one place, or may be distributed on a plurality of network units. Some or all of the units may be selected based on actual requirements to achieve the objectives of the solutions of embodiments. In addition, the functional units in embodiments of this application may be integrated into one processing unit, each of the units may exist alone physically, or two or more units may be integrated into one unit. When the foregoing functions are implemented in a form of a software functional unit and sold or used as an independent product, the functions may be stored in a computer-readable storage medium. Based on such an understanding, the technical solutions of this application essentially,

the part contributing to the conventional technology, or a part of the technical solutions may be implemented in a form of a software product. The computer software product is stored in a storage medium, and includes several instructions for enabling a computer device (which may be a personal computer, a server, a network device, or the like) to perform all or some of the steps of the methods described in embodiments of this application. The storage medium includes any medium that can store program code, such as a USB flash drive, a removable hard disk, a read-only memory, a random access memory, a magnetic disk, or an optical disc.

CLAIMS

1. A communication method, comprising:

determining a polynomial exponent sequence, wherein a coefficient of a highest-degree term of the polynomial exponent sequence is correlated with a first coefficient, the first coefficient is any one of coefficients from a coefficient of a second-highest-degree term to a coefficient of a second-degree term of the polynomial exponent sequence, and a degree of the polynomial exponent sequence is greater than or equal to 4; and

sending the polynomial exponent sequence.

2. The method according to claim 1, wherein the first coefficient is correlated with a first parameter, and the first parameter is one of a maximum delay spread and a maximum Doppler spread.

3. The method according to claim 2, wherein a coefficient of a first-degree term of the polynomial exponent sequence is correlated with a second parameter, the second parameter is one of the maximum delay spread and the maximum Doppler spread, and the first parameter is different from the second parameter.

4. The method according to any one of claims 1 to 3, wherein

the polynomial exponent sequence is $s_{a_D,a_{D-1},\ldots,a_1}(n) = e^{-j2\pi(a_D n^D + a_{D-1} n^{D-1} + \cdots + a_1 n)/N}$, wherein $n = 0,1,\ldots,N-1$; and

N is a sequence length of the polynomial exponent sequence, N is a prime number, D is the degree of the polynomial exponent sequence, and $a_D, a_{D-1}, \ldots, a_1$ are respectively coefficients of D^{th}-, $(D-1)^{\text{th}}$-, …, and first-degree terms of the polynomial exponent sequence.

5. The method according to claim 4, wherein the polynomial exponent sequence comprises a base sequence and an auxiliary sequence, that is, $s_{a_D,a_{D-1},\ldots,a_1}(n) = u_{a_D}(n) \cdot v_{a_{D-1},a_{D-2},\ldots,a_1}(n)$, wherein $n = 0,1,\ldots,N-1$;

the base sequence is $u_{a_D}(n) = e^{-j2\pi a_D n^D/N}$; and

the auxiliary sequence is $v_{a_{D-1},a_{D-2},\ldots,a_1}(n) = e^{-j2\pi(a_{D-1} n^{D-1} + a_{D-2} n^{D-2} + \cdots + a_1 n)/N}$.

6. The method according to any one of claims 1 to 5, wherein the first coefficient is the coefficient of the second-highest-degree term of the polynomial exponent sequence.

7. The method according to any one of claims 4 to 6, wherein the polynomial exponent sequence is mapped by using a time domain resource, the first parameter is the maximum delay spread, and the second parameter is the maximum Doppler spread.

8. The method according to claim 7, wherein a discrete-time signal of the polynomial exponent sequence is as follows:

$\bar{s}_{\lambda_D,\lambda_{D-1},\ldots,\lambda_1}(n) = e^{-j2\pi(\lambda_D n^D + D\lambda_D\lambda_{D-1}\Delta_T n^{D-1} + \lambda_{D-2}n^{D-2} + \cdots + \lambda_2 n^2 + \lambda_1\Delta_F n)/N}$, wherein

$\lambda_D \in \{1,2,\ldots,N-1\}, \lambda_{D-1} \in \{0,1,\ldots,\lfloor N/\Delta_T \rfloor - 1\}, \lambda_{D-2},\ldots,\lambda_2 \in \{0,1,\ldots,N-1\}, \lambda_1 \in \{0,1,\ldots,\lfloor N/\Delta_F \rfloor - 1\}$, Δ_T represents the maximum delay spread, and Δ_F represents the maximum Doppler spread.

9. The method according to claim 8, wherein $D = 4$, and the discrete-time signal of the polynomial exponent sequence is as follows:

$\bar{s}_{\lambda,\mu,k,l}(n) = e^{-j2\pi(\lambda n^4 + 4\lambda\mu\Delta_T n^3 + kn^2 + l\Delta_F n)/N}$, wherein

$\lambda \in \{1,2,\ldots,N-1\}, \mu \in \{0,1,\ldots,\lfloor N/\Delta_T \rfloor - 1\}, k \in \{0,1,\ldots,N-1\}, l \in \{0,1,\ldots,\lfloor N/\Delta_F \rfloor - 1\}$.

10. The method according to any one of claims 4 to 6, wherein the polynomial exponent sequence is mapped by using a frequency domain resource, the first parameter is the maximum Doppler spread, and the second parameter is the maximum delay spread.

11. The method according to claim 10, wherein a discrete-time signal of the polynomial exponent sequence is as follows:

$\bar{s}_{\lambda_D,\lambda_{D-1},\ldots,\lambda_1}(n) = \frac{1}{\sqrt{N}}\sum_{m=0}^{N-1} e^{-j2\pi(\lambda_D m^D + D\lambda_D\lambda_{D-1}\Delta_F m^{D-1} + \lambda_{D-2}m^{D-2} + \cdots + \lambda_2 m^2 + \lambda_1\Delta_T m)/N} \cdot e^{j2\pi mn/N}$, wherein

$\lambda_D \in \{1,2,\ldots,N-1\}, \lambda_{D-1} \in \{0,1,\ldots,\lfloor N/\Delta_F \rfloor - 1\}, \lambda_{D-2},\ldots,\lambda_2 \in \{0,1,\ldots,N-1\}, \lambda_1 \in \{0,1,\ldots,\lfloor N/\Delta_T \rfloor - 1\}$, Δ_T represents the maximum delay spread, and Δ_F represents the maximum Doppler spread.

12. The method according to claim 11, wherein $D = 4$, and the discrete-time signal of the polynomial exponent sequence is as follows:

$\bar{s}_{\lambda,\mu,k,l}(n) = \frac{1}{\sqrt{N}}\sum_{m=0}^{N-1} e^{-j2\pi(\lambda m^4 + 4\lambda\mu\Delta_F m^3 + km^2 + l\Delta_T m)/N} \cdot e^{j2\pi mn/N}$, wherein

$\lambda \in \{1,2,\ldots,N-1\}, \mu \in \{0,1,\ldots,\lfloor N/\Delta_F \rfloor - 1\}, k \in \{0,1,\ldots,N-1\}, l \in \{0,1,\ldots,\lfloor N/\Delta_T \rfloor - 1\}$.

13. The method according to any one of claims 1 to 12, wherein a maximum value of an ambiguity function of the polynomial exponent sequence does not exceed $(D-1)\sqrt{N}$, N is the sequence length of the polynomial exponent sequence, and D is the degree of the polynomial exponent sequence.

14. The method according to any one of claims 1 to 13, wherein sequence capacity of the polynomial exponent sequence is $(N-1)\cdot N^{D-3}\cdot\lfloor N/\Delta_T \rfloor\cdot\lfloor N/\Delta_F \rfloor$, N is the sequence length of the polynomial exponent sequence, Δ_T represents the maximum delay spread, and Δ_F represents the maximum Doppler spread.

15. The method according to any one of claims 1 to 14, wherein the method further comprises:

determining indication information, wherein the indication information indicates the polynomial exponent sequence.

16. The method according to claim 15, wherein the indication information comprises one or more coefficients of the polynomial exponent sequence.

17. A communication apparatus, comprising:

a processing unit, configured to determine a polynomial exponent sequence, wherein a coefficient of a highest-degree term of the polynomial exponent sequence is correlated with a first coefficient, the first coefficient is any one of coefficients from a coefficient of a second-highest-degree term to a coefficient of a second-degree term of the polynomial exponent sequence, and a degree of the polynomial exponent sequence is greater than or equal to 4; and

a transceiver unit, configured to send the polynomial exponent sequence.

18. A communication apparatus, comprising a processor, wherein the processor is configured to enable, by executing a computer program or instructions or via a logic circuit,

the communication apparatus to perform the method according to any one of claims 1 to 16.

19. A computer-readable storage medium, wherein the computer-readable storage medium stores a computer program or instructions, and when the computer program or the instructions are executed on a computer,

the method according to any one of claims 1 to 16 is performed.

20. A computer program product, comprising instructions, wherein when the instructions are executed on a computer,

the method according to any one of claims 1 to 16 is performed.