

WHAT IS CLAIMED IS:

1. A method for determining precoding based on a codebook, performed by a terminal, the method comprising:

determining, based on at least one channel status information reference signal (CSI-RS) resource, channel information corresponding to each CSI-RS resource; and

sending, according to the channel information determined corresponding to each CSI-RS resource and codebook parameter information, CSI to a network device, wherein the CSI comprises indication information corresponding to a plurality of CSI-RS resources and indication information corresponding to each CSI-RS resource, or the CSI comprises indication information corresponding to a plurality of port groups in one CSI-RS resource and indication information corresponding to each port group, the port group comprises a plurality of CSI-RS ports corresponding to the CSI-RS resource;

wherein the CSI is configured to determine precoding of the terminal based on a codebook structure corresponding to the codebook parameter information.

2. The method according to claim 1, wherein the CSI comprises at least one of following information:

N pieces of spatial domain basis vector indication information or N pieces of port selection indication information, where N is the same as a number of the CSI-RS resources or a number of the port groups, and N is a positive integer greater than 1;

combination coefficient indication information, wherein the combination coefficient indication information corresponds to the plurality of CSI-RS resources or the plurality of port groups in the one CSI-RS resource; or

frequency domain basis vector indication information, wherein the frequency domain basis vector indication information corresponds to the plurality of CSI-RS resources or the plurality of port groups in the one CSI-RS resource; or

wherein the CSI comprises at least one of following information:

G pieces of spatial domain basis vector indication information or G pieces of port selection indication information;

G pieces of combination coefficient indication information; or

G pieces of frequency domain basis vector indication information;

wherein G is the same as a number of CSI-RS resource groups in the plurality of CSI-RS resources, and the CSI-RS resource group comprises at least one CSI-RS resource, or G is the same as a number of first groups among the plurality of port groups in the one CSI-RS resource, and the first group comprises at least one port group, and G is a positive integer greater than 1; or

wherein the CSI comprises at least one of following information:

spatial domain basis vector indication information or port selection indication information, wherein the spatial domain basis vector indication information or the port selection indication information corresponds to the plurality of CSI-RS resources, or the plurality of port groups in the one CSI-RS resource;

combination coefficient indication information, wherein the combination coefficient indication information corresponds to the plurality of CSI-RS resources or the plurality of port groups in the one CSI-RS resource; or

frequency domain basis vector indication information, wherein the frequency domain basis vector indication information corresponds to the plurality of CSI-RS resources or the plurality of port groups in the one CSI-RS resource.

3. The method according to claim 1 or 2, wherein the combination coefficient indication information comprises non-zero coefficient information and non-zero coefficient position information, the non-zero coefficient information indicates non-zero coefficient(s) in the combination coefficient indication information, and the non-zero coefficient position information indicates a position of the non-zero coefficient in the combination coefficient indication information.

4. The method according to claim 1 or 2, wherein sending, according to the channel information determined corresponding to each CSI-RS resource and codebook parameter information, CSI to the network device comprises:

determining, according to channel information or valid channel information corresponding to each CSI-RS resource and the codebook parameter information, the spatial domain basis vector indication information or the port selection indication information, the

combination coefficient indication information and the frequency domain basis vector indication information; and

sending the CSI to the network device, wherein the CSI comprises the spatial domain basis vector indication information or the port selection indication information, the combination coefficient indication information and the frequency domain basis vector indication information.

5. The method according to claim 1, further comprising:

receiving configuration information from the network device, wherein the configuration information is used to configure the codebook parameter information, and the codebook parameter information is used by the terminal to determine the CSI.

6. The method according to claim 5, further comprising one of:

sending first indication information to the network device, wherein the first indication information indicates an adopted codebook structure; or

receiving second indication information from the network device, wherein the second indication information indicates an adopted codebook structure.

7. The method according to claim 1, wherein the CSI-RS resource is a channel measurement resource (CMR).

8. The method according to claim 7, wherein different CMRs belong to a same CSI-RS resource set or different CSI-RS resource sets.

9. The method according to claim 1, wherein each of the plurality of CSI-RS resources corresponds to one transmission reception point (TRP), and at least two TRPs are configured for coherent joint transmission (CJT); or

each of the plurality of port groups in the one CSI-RS resource corresponds to one TRP, and at least two TRPs are configured for CJT.

10. A method for determining precoding based on a codebook, performed by a network device, the method comprising:

receiving channel status information (CSI) from a terminal, wherein the CSI comprises indication information corresponding to a plurality of channel status information reference signal (CSI-RS) resources and indication information corresponding to each CSI-RS

resource, or the CSI comprises indication information corresponding to a plurality of port groups in one CSI-RS resource and indication information corresponding to each port group, the port group comprises a plurality of CSI-RS ports corresponding to the CSI-RS resource, and the CSI is determined by a terminal based on channel information corresponding to each CSI-RS resource in at least one CSI-RS resource and codebook parameter information; and determining, according to the CSI and a codebook structure corresponding to the codebook parameter information, precoding of the terminal.

11. The method according to claim 10, wherein the CSI comprises at least one of following information:

N pieces of spatial domain basis vector indication information or N pieces of port selection indication information, where N is the same as a number of the CSI-RS resources or a number of the port groups, and N is a positive integer greater than 1;

combination coefficient indication information, wherein the combination coefficient indication information corresponds to the plurality of CSI-RS resources or the plurality of port groups in the one CSI-RS resource; or

frequency domain basis vector indication information, wherein the frequency domain basis vector indication information corresponds to the plurality of CSI-RS resources or the plurality of port groups in the one CSI-RS resource.

12. The method according to claim 11, wherein the codebook structure is expressed by following formulas:

$$\mathbf{W} = \begin{bmatrix} \mathbf{W}_{1,1} & & \\ & \ddots & \\ & & \mathbf{W}_{1,N} \end{bmatrix} \widetilde{\mathbf{W}}_2 \mathbf{W}_f^H, \quad \mathbf{W}_{1,i} \in \mathbb{C}^{N_t \times 2L_i} \text{ or } \mathbf{W}_{1,i} \in \mathbb{C}^{P \times 2L_i}, \quad \widetilde{\mathbf{W}}_2 \in \mathbb{C}^{\sum_{i=1}^N 2L_i \times M},$$

$$\mathbf{W}_f \in \mathbb{C}^{N_3 \times M}$$

where $\mathbf{W}$ represents the codebook structure, N represents the number of the CSI-RS resources or the number of the port groups, N_t represents a number of transmitting antenna ports, P is a number of CSI-RS ports, L_i represents a number of spatial domain basis vectors or a number of CSI-RS ports corresponding to an i^{th} CSI-RS resource, $i \in \{1, \dots, N\}$, or a number of spatial domain basis vectors or a number of CSI-RS ports corresponding to an i^{th} port group, $i \in \{1, \dots, N\}$, M represents a number of frequency domain basis vectors

corresponding to the i^{th} CSI-RS resource, or a number of frequency domain basis vectors corresponding to the i^{th} port group, N_3 represents a number of precoding matrix indication (PMI) subbands, $\mathbf{W}_{1,i}$ represents a matrix consisting of L_i spatial domain basis vectors or unit basis vectors for port selection corresponding to the i^{th} CSI-RS resource, or a matrix consisting of L_i spatial domain basis vectors or unit basis vectors for port selection corresponding to the i^{th} port group, $\widetilde{\mathbf{W}}_2$ represents a matrix consisting of the combination coefficient indication information, $\mathbf{W}_f$ represents a matrix consisting of M frequency domain basis vectors, $\mathbf{H}$ is a conjugate transpose, and $\mathbb{C}^{X \times Y}$ represents a complex matrix with dimensions of X rows and Y columns.

13. The method according to claim 10, wherein the CSI comprises at least one of following information:

G pieces of spatial domain basis vector indication information or G pieces of port selection indication information;

G pieces of combination coefficient indication information; or

G pieces of frequency domain basis vector indication information;

wherein G is the same as a number of CSI-RS resource groups in the plurality of CSI-RS resources, and the CSI-RS resource group comprises at least one CSI-RS resource, or G is the same as a number of first groups among the plurality of port groups in the one CSI-RS resource, and the first group comprises at least one port group, and G is a positive integer greater than 1.

14. The method according to claim 13, wherein the codebook structure is expressed by following formulas:

$$\mathbf{W} = \begin{bmatrix} \mathbf{W}_{1,1} \widetilde{\mathbf{W}}_{2,1} \mathbf{W}_{f,1}^H \\ \vdots \\ \mathbf{W}_{1,g} \widetilde{\mathbf{W}}_{2,g} \mathbf{W}_{f,g}^H \end{bmatrix}, \quad \mathbf{W}_{1,g} \in \mathbb{C}^{N_g N_t \times 2L_g}, \quad \widetilde{\mathbf{W}}_{2,g} \in \mathbb{C}^{2L_g \times M_g}, \quad \mathbf{W}_{f,g}^H \in \mathbb{C}^{N_3 \times M_g}$$

where the $\mathbf{W}$ represents the codebook structure, $\mathbf{W}_{1,g}$ represents a matrix consisting of spatial domain basis vectors or unit basis vectors for port selection corresponding to CSI-RS resources in a g^{th} group, $g \in \{1, \dots, G\}$, or a matrix consisting of spatial domain basis vectors or unit basis vectors for port selection corresponding to port groups in a g^{th} group, N_g represents a number of CSI-RS resources or a number of port groups in the g^{th} group, N_t

represents a number of transmitting antenna ports, $\mathbf{W}_{f,g}$ represents a matrix consisting of $\mathbf{M}_g$ frequency domain basis vectors corresponding to CSI-RS resources in the g^{th} group, or a matrix consisting of $\mathbf{M}_g$ frequency domain basis vectors corresponding to port groups in the g^{th} group, $\mathbf{M}_g$ represents a number of frequency domain basis vectors selected for the g^{th} group, $\widetilde{\mathbf{W}}_{2,g}$ represents a matrix consisting of combination coefficients corresponding to CSI-RS resources in the g^{th} group, or a matrix consisting of combination coefficients corresponding to port groups in the g^{th} group, $\mathbf{L}_g$ represents a number of spatial domain basis vectors or a number of CSI-RS ports selected for the g^{th} group, G represents being the same as the number of CSI-RS resource groups in the plurality of CSI-RS resources or the number of first groups among the port groups, G is a positive integer greater than 1, N_3 represents a number of precoding matrix indication (PMI) subbands, $\mathbf{H}$ is a conjugate transpose, and $\mathbb{C}^{X \times Y}$ represents a complex matrix with dimensions of X rows and Y columns.

15. The method according to claim 10, wherein the CSI comprises at least one of following information:

spatial domain basis vector indication information, wherein the spatial domain basis vector indication information corresponds to the plurality of CSI-RS resources, or the plurality of port groups in the one CSI-RS resource;

combination coefficient indication information, wherein the combination coefficient indication information corresponds to the plurality of CSI-RS resources, or the plurality of port groups in the one CSI-RS resource;

frequency domain basis vector indication information, wherein the frequency domain basis vector indication information corresponds to the plurality of CSI-RS resources, or the plurality of port groups in the one CSI-RS resource.

16. The method according to claim 15, wherein the codebook structure is expressed by following formulas:

$$\mathbf{W} = \mathbf{W}_1 \widetilde{\mathbf{W}}_2 \mathbf{W}_f^H, \quad \mathbf{W}_1 \in \mathbb{C}^{N N_t \times 2L}, \text{ or } \mathbf{W}_1 \in \mathbb{C}^{N P \times 2L}, \quad \widetilde{\mathbf{W}}_2 \in \mathbb{C}^{2L \times M}, \quad \mathbf{W}_f \in \mathbb{C}^{N_3 \times M}$$

where $\mathbf{W}$ represents the codebook structure, N represents the number of the CSI-RS resources or the number of the port groups, N_t represents a number of transmitting antenna ports, L represents a number of spatial domain basis vectors or CSI-RS ports corresponding

to the CSI-RS resources, or a number of spatial domain basis vectors or CSI-RS ports corresponding to the port groups, M represents a number of frequency domain basis vectors corresponding to the CSI-RS resources, or a number of frequency domain basis vectors corresponding to the port groups, N_3 represents a number of precoding matrix indication (PMI) subbands, $\mathbf{W}_1$ represents a matrix consisting of L spatial domain basis vectors or unit basis vectors for port selection for the CSI-RS resources, or a matrix consisting of L spatial domain basis vectors or unit basis vectors for port selection for the port groups, $\widetilde{\mathbf{W}}_2$ represents a matrix consisting of the combination coefficient indication information, $\mathbf{W}_f$ represents a matrix consisting of M frequency domain basis vectors, $\mathbf{H}$ is a conjugate transpose, and $\mathbb{C}^{X \times Y}$ represents a complex matrix with dimensions of X rows and Y columns.

17. The method according to any one of claims 11 to 16, wherein the combination coefficient indication information comprises non-zero coefficient information and non-zero coefficient position information, the non-zero coefficient information indicates a non-zero coefficient in the combination coefficient indication information, and the non-zero coefficient position information indicates a position of the non-zero coefficient in the combination coefficient indication information; and

wherein receiving the CSI from the terminal comprises:

receiving the CSI from the terminal, wherein the CSI comprises the spatial domain basis vector indication information or the port selection indication information, the combination coefficient indication information and the frequency domain basis vector indication information;

the spatial domain basis vector indication information or the port selection indication information, the combination coefficient indication information and the frequency domain basis vector indication information are determined by the terminal according to channel information or valid channel information corresponding to each CSI-RS resource and the codebook parameter information.

18. The method according to claim 10, further comprising:

sending configuration information to the terminal, wherein the configuration information is used to configure the codebook parameter information, and the codebook

parameter information is used by the terminal to determine the CSI; and

receiving first indication information from the terminal, wherein the first indication information indicates an adopted codebook structure; or

sending second indication information to the terminal, wherein the second indication information indicates an adopted codebook structure;

wherein the CSI-RS resource is a channel measurement resource (CMR);

wherein different CMRs belong to a same CSI-RS resource set or different CSI-RS resource sets;

each of the plurality of CSI-RS resources corresponds to one transmission reception point (TRP), and at least two TRPs are configured for coherent joint transmission (CJT); or

each of the plurality of port groups in the one CSI-RS resource corresponds to a TRP, and at least two TRPs are configured for CJT.

19. A terminal, comprising:

a processor;

a transceiver connected to the processor;

wherein the processor is configured to load and execute executable instructions, to implement the method for determining precoding based on a codebook according to any one of claims 1 to 9.

20. A network device, comprising:

a processor;

a transceiver connected to the processor;

wherein the processor is configured to load and execute executable instructions, to implement the method for determining precoding based on a codebook according to any one of claims 10 to 18.