

CLAIMS

1. A transmission method for a base station apparatus comprising:
 - generating control information indicating whether or not to execute a precoding process that regularly changes phase with respect to first modulated symbols s1 and second modulated symbols s2;
 - mapping the control information to control information symbols by using a mapper; and
 - transmitting the control information symbols from one or more antennas to a terminal apparatus, wherein
 - in a case of executing the precoding process, first symbols z1 and second symbols z2 to be transmitted from the one or more antennas to the terminal apparatus are generated by
 - applying the precoding process, by using a precoder, on the first modulated symbols s1 and the second modulated symbols s2 by using a matrix selected from among 2 matrices F[i] to generate the first symbols z1 and the second symbols z2, i being equal to an integer 0 and 1; and
 - applying a transmission to the first symbols z1 and the second symbols z2 from the one or more antennas, wherein
 - the 2 matrices F[i] is regularly changing a phase of the first modulated symbols s1 and a phase of the second modulated symbols s2,
 - each of the 2 matrices F[i] is selected at least once in 2 symbols,
 - the first symbols z1 and the second symbols z2 satisfy $(z1, z2)^T = F[i] (s1, s2)^T$, and
 - the 2 matrices F[i] are expressed by the following equations:

$$F[i] = \frac{1}{\sqrt{2}} \begin{pmatrix} e^{j0} & e^{j0} \\ e^{j\theta_{21}(i)} & e^{j(\theta_{21}(i)+\pi)} \end{pmatrix}$$

$$\theta_{21}(0) = 0, \theta_{21}(1) = \frac{\pi}{2}$$

2. A base station apparatus comprising:

control information generating circuitry that, in operation, generates control information indicating whether or not to execute a precoding process that regularly changes phase with respect to first modulated symbols s_1 and second modulated symbols s_2 ;

mapping circuitry that, in operation, maps the control information to control information symbols; and

transmission circuitry that, in operation, transmits the control information symbols from one or more antennas to a terminal apparatus, wherein

in a case of executing the precoding process, first symbols z_1 and second symbols z_2 to be transmitted to the terminal apparatus are generated by

applying the precoding process, by using a precoder, on the first modulated symbols s_1 and the second modulated symbols s_2 by using a matrix selected from among 2 matrices $F[i]$ to generate the first symbols z_1 and the second symbols z_2 , i being equal to an integer 0 and 1; and

applying a transmission to the first symbols z_1 and the second symbols z_2 from the one or more antennas, wherein

the 2 matrices $F[i]$ is regularly changing a phase of the first modulated symbols s_1 and a phase of the second modulated symbols s_2 ,

each of the 2 matrices $F[i]$ is selected at least once in 2 symbols,

the first symbols z_1 and the second symbols z_2 satisfy $(z_1, z_2)^T = F[i] (s_1, s_2)^T$, and

the 2 matrices $F[i]$ are expressed by the following equations:

$$F[i] = \frac{1}{\sqrt{2}} \begin{pmatrix} e^{j0} & e^{j0} \\ e^{j\theta_{21}(i)} & e^{j(\theta_{21}(i)+\pi)} \end{pmatrix}$$
$$\theta_{21}(0) = 0, \theta_{21}(1) = \frac{\pi}{2}$$

3. A reception method for a terminal apparatus comprising:

receiving control information symbols and a plurality of data symbols with one or more antennas;

detecting, from the control information symbols, control information indicating whether or not a precoding process is executed with respect to a plurality of data symbols; and

applying a decoding process, by using a decoder, on the plurality of data symbols based on the detection result of the control information symbols, wherein

in a case of executing the precoding process, a base station apparatus generates first symbols z_1 and second symbols z_2 , to be transmitted from one or more antennas of the base station apparatus to the terminal apparatus, by

applying the precoding process, by using a precoder, on first modulated symbols s_1 and second modulated symbols s_2 by using a matrix selected from among 2 matrices $F[i]$ to generate the first symbols z_1 and the second symbols z_2 , i being equal to an integer 0 and 1; and

applying a transmission to the first symbols z_1 and the second symbols z_2 from the one or more antennas of the base station apparatus, wherein

the 2 matrices $F[i]$ is regularly changing a phase of the first modulated symbols s_1 and a phase of the second modulated symbols s_2 ,

each of the 2 matrices $F[i]$ is selected at least once in 2 symbols,

the first symbols z_1 and the second symbols z_2 satisfy $(z_1, z_2)^T = F[i] (s_1, s_2)^T$, and

the 2 matrices $F[i]$ are expressed by the following equations:

$$F[i] = \frac{1}{\sqrt{2}} \begin{pmatrix} e^{j0} & e^{j0} \\ e^{j\theta_{21}(i)} & e^{j(\theta_{21}(i)+\pi)} \end{pmatrix}$$
$$\theta_{21}(0) = 0, \theta_{21}(1) = \frac{\pi}{2}$$

4. A terminal apparatus comprising:

reception circuitry that, in operation, receives control information symbols and a plurality of data symbols with one or more antennas;

detecting circuitry that, in operation, detects, from the control information symbols, control information indicating whether or not a precoding process is executed with respect to a plurality of data symbols; and

decoding circuitry that, in operation, applies a decoding process to the plurality of data symbols based on the detection result of the control information symbols, wherein

in a case of executing the precoding process, a base station apparatus generates first symbols z_1 and second symbols z_2 , to be transmitted from one or more antennas of the base station apparatus to the terminal apparatus, by

applying the precoding process, by using a precoder, on first modulated symbols s_1 and second modulated symbols s_2 by using a matrix selected from among 2 matrices $F[i]$ to generate the first symbols z_1 and the second symbols z_2 , i being equal to an integer 0 and 1; and

applying a transmission to the first symbols z_1 and the second symbols z_2 from the one or more antennas of the base station apparatus, wherein

the 2 matrices $F[i]$ is regularly changing a phase of the first modulated symbols s_1 and a phase of the second modulated symbols s_2 ,

each of the 2 matrices $F[i]$ is selected at least once in 2 symbols,

the first symbols z_1 and the second symbols z_2 satisfy $(z_1, z_2)^T = F[i] (s_1, s_2)^T$, and

the 2 matrices $F[i]$ are expressed by the following equations:

$$F[i] = \frac{1}{\sqrt{2}} \begin{pmatrix} e^{j0} & e^{j0} \\ e^{j\theta_{21}(i)} & e^{j(\theta_{21}(i)+\pi)} \end{pmatrix}$$

$$\theta_{21}(0) = 0, \theta_{21}(1) = \frac{\pi}{2}$$