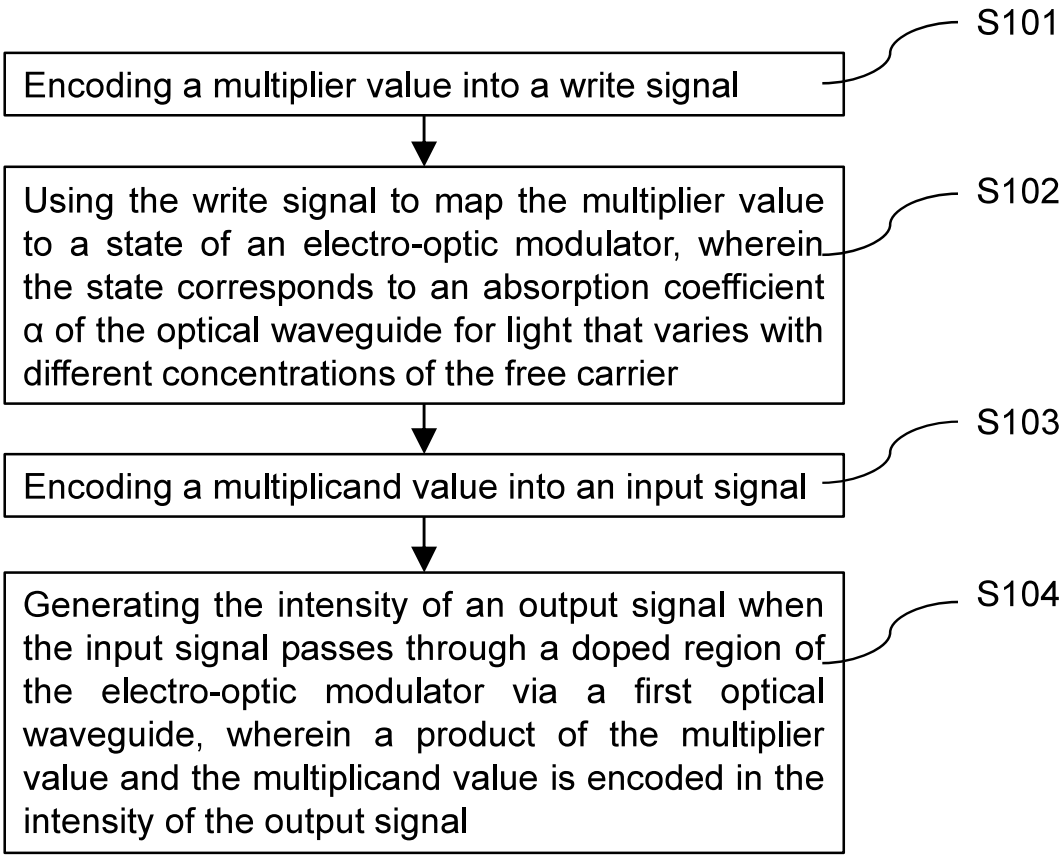

S101
Encoding a multiplier value into a write signal
S102
Using the write signal to map the multiplier value to a state of an electro-optic modulator, wherein the state corresponds to an absorption coefficient α of the optical waveguide for light that varies with different concentrations of the free carrier
S103
Encoding a multiplicand value into an input signal
S104
Generating the intensity of an output signal when the input signal passes through a doped region of the electro-optic modulator via a first optical waveguide, wherein a product of the multiplier value and the multiplicand value is encoded in the intensity of the output signal

Fig. 1

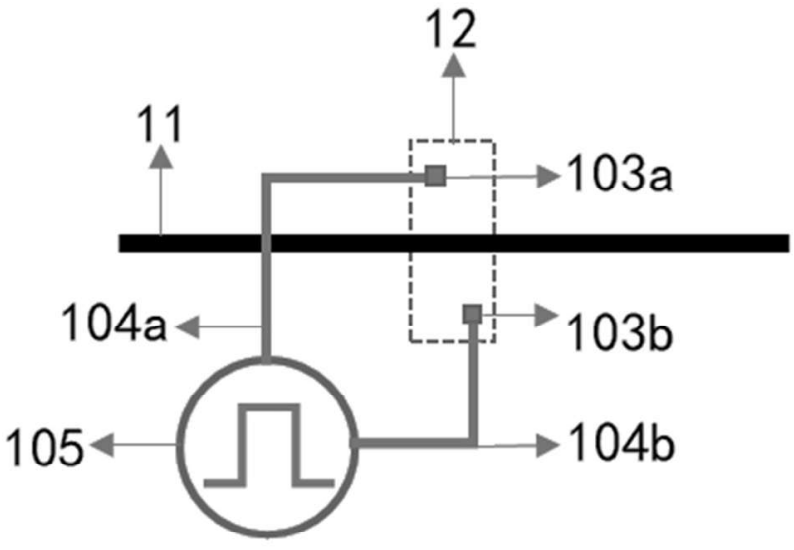

12
11
103a
104a
103b
105
104b

Fig. 2

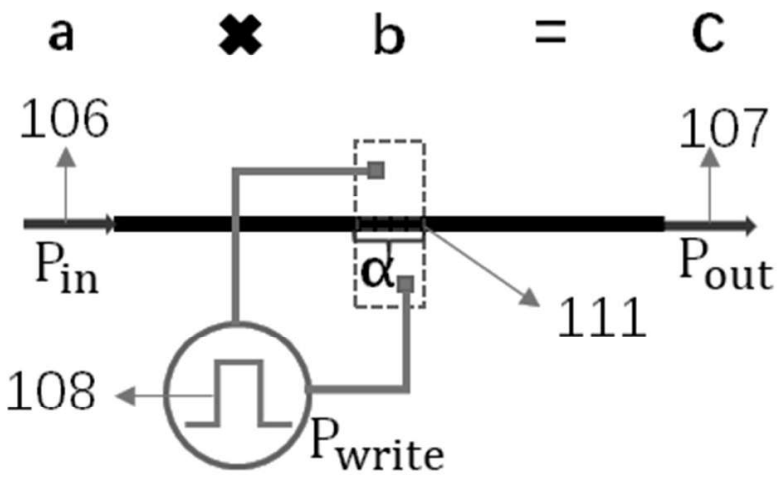


Fig. 3

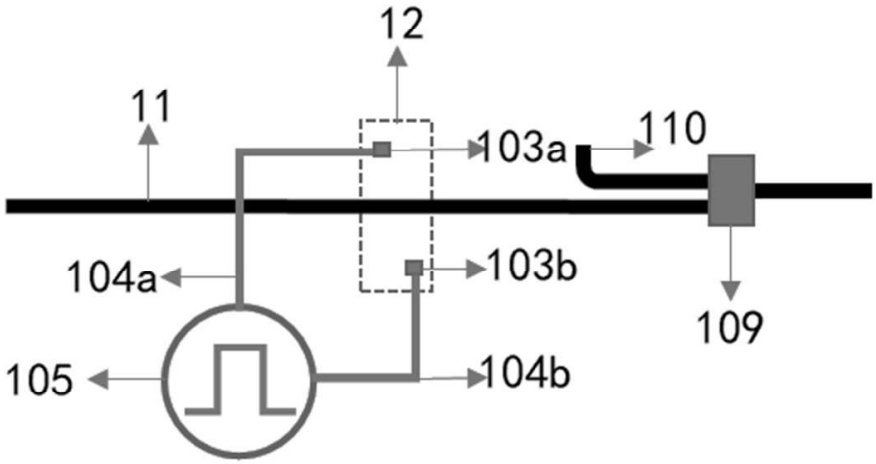


Fig. 4

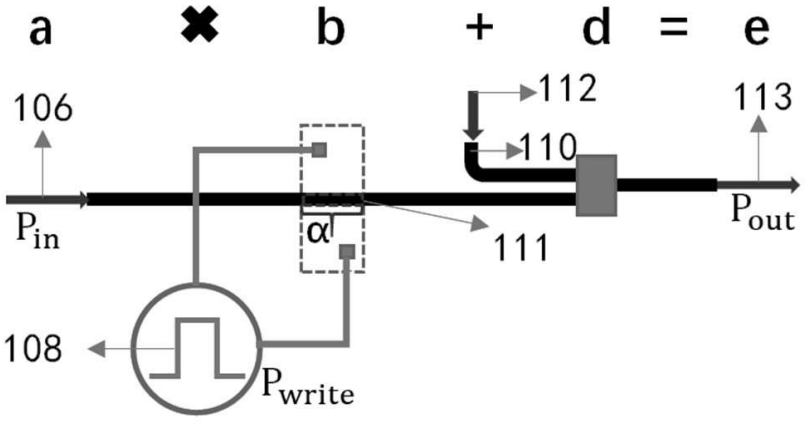


Fig. 5

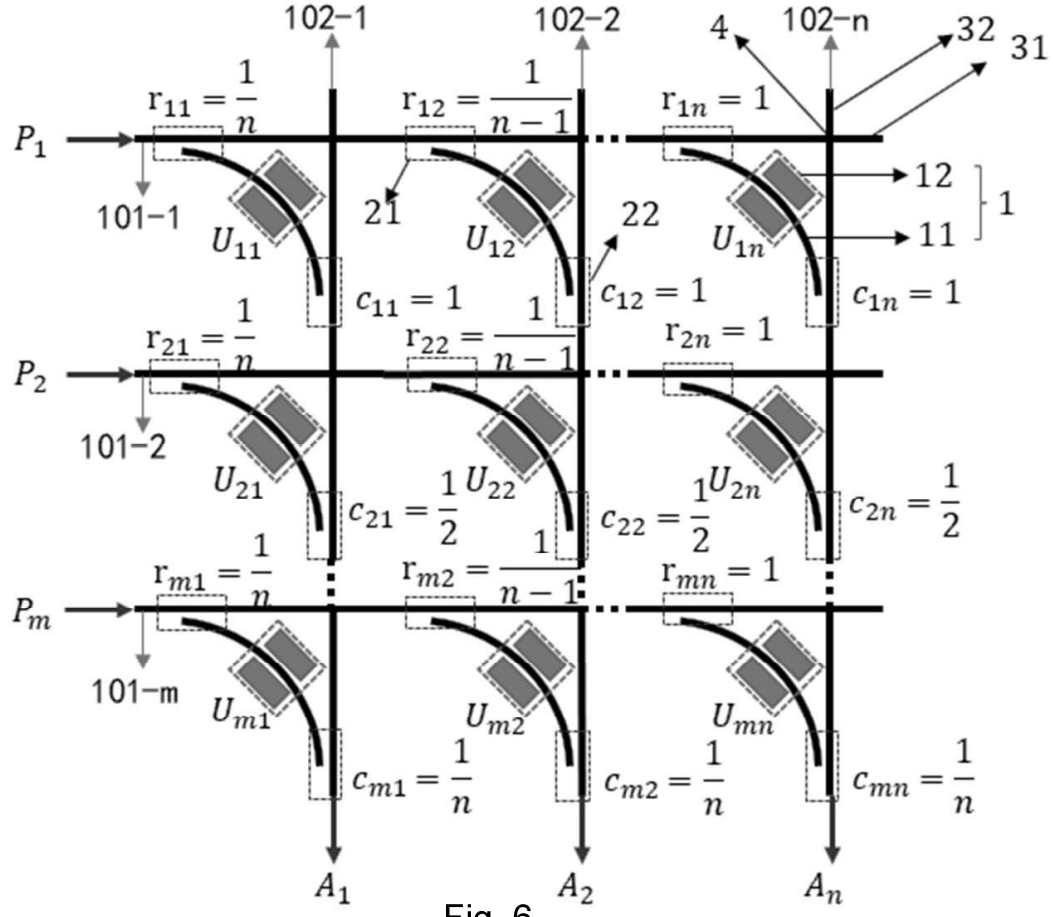

102−1
102−2
4
102−n
32
31
$r_{11}=\frac{1}{n}$
$r_{12}=\frac{1}{n-1}$
$r_{1n}=1$
P_1
101−1
U_{11}
21
U_{12}
22
U_{1n}
12
11
1
$c_{11}=1$
$c_{12}=1$
$c_{1n}=1$
$r_{21}=\frac{1}{n}$
$r_{22}=\frac{1}{n-1}$
$r_{2n}=1$
P_2
101−2
U_{21}
U_{22}
U_{2n}
$c_{21}=\frac{1}{2}$
$c_{22}=\frac{1}{2}$
$c_{2n}=\frac{1}{2}$
$r_{m1}=\frac{1}{n}$
$r_{m2}=\frac{1}{n-1}$
$r_{mn}=1$
P_m
101−m
U_{m1}
U_{m2}
U_{mn}
$c_{m1}=\frac{1}{n}$
$c_{m2}=\frac{1}{n}$
$c_{mn}=\frac{1}{n}$
A_1
A_2
A_n

Fig. 6

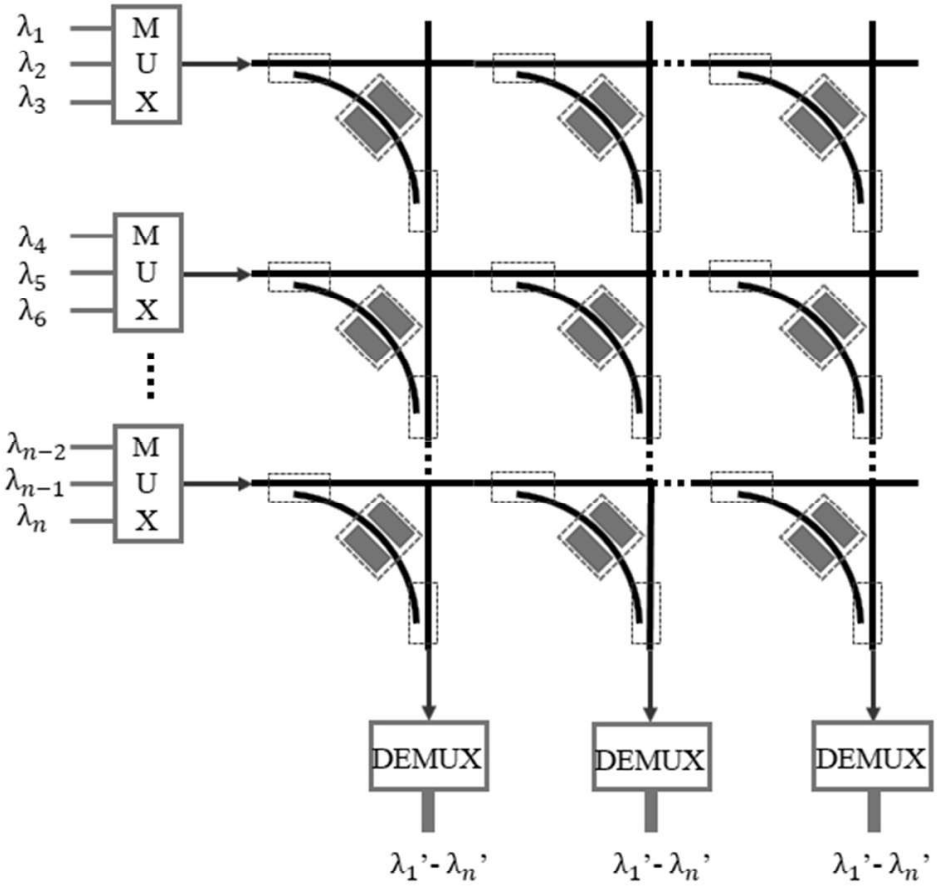

λ_1
λ_2
λ_3
MUX
λ_4
λ_5
λ_6
MUX
λ_{n-2}
λ_{n-1}
λ_n
MUX
DEMUX
DEMUX
DEMUX
λ_1'-λ_n'
λ_1'-λ_n'
λ_1'-λ_n'

Fig. 7

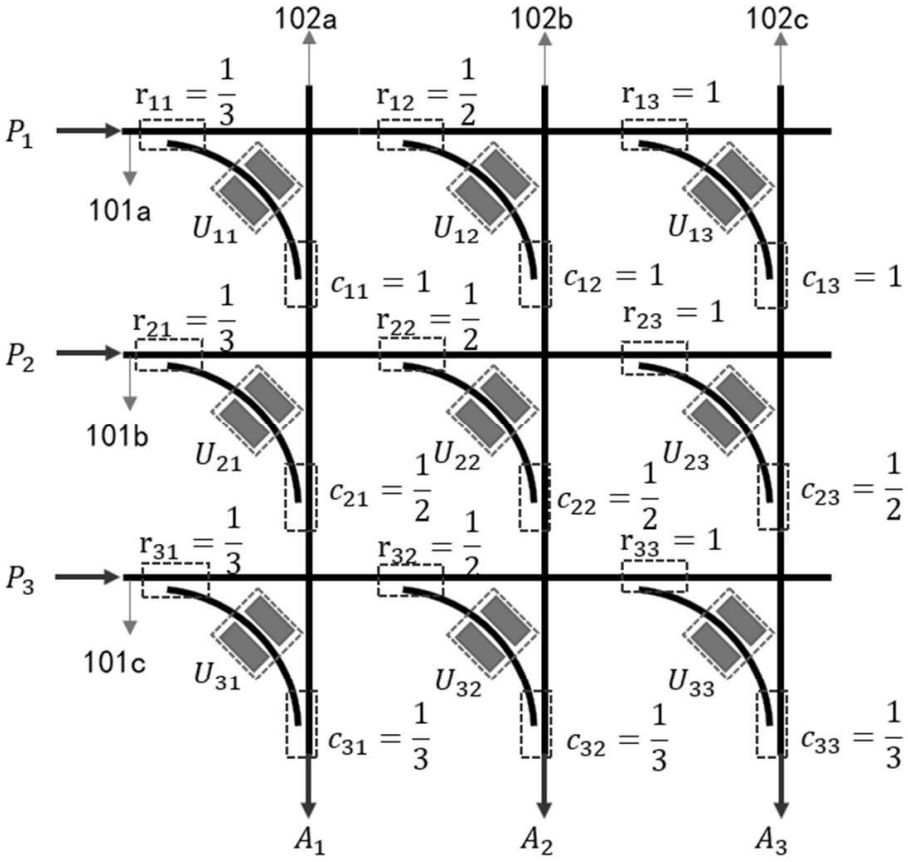

102a
102b
102c
$r_{11} = \frac{1}{3}$
$r_{12} = \frac{1}{2}$
$r_{13} = 1$
P_1
101a
U_{11}
U_{12}
U_{13}
$c_{11} = 1$
$c_{12} = 1$
$c_{13} = 1$
$r_{21} = \frac{1}{3}$
$r_{22} = \frac{1}{2}$
$r_{23} = 1$
P_2
101b
U_{21}
U_{22}
U_{23}
$c_{21} = \frac{1}{2}$
$c_{22} = \frac{1}{2}$
$c_{23} = \frac{1}{2}$
$r_{31} = \frac{1}{3}$
$r_{32} = \frac{1}{2}$
$r_{33} = 1$
P_3
101c
U_{31}
U_{32}
U_{33}
$c_{31} = \frac{1}{3}$
$c_{32} = \frac{1}{3}$
$c_{33} = \frac{1}{3}$
A_1
A_2
A_3

Fig. 8

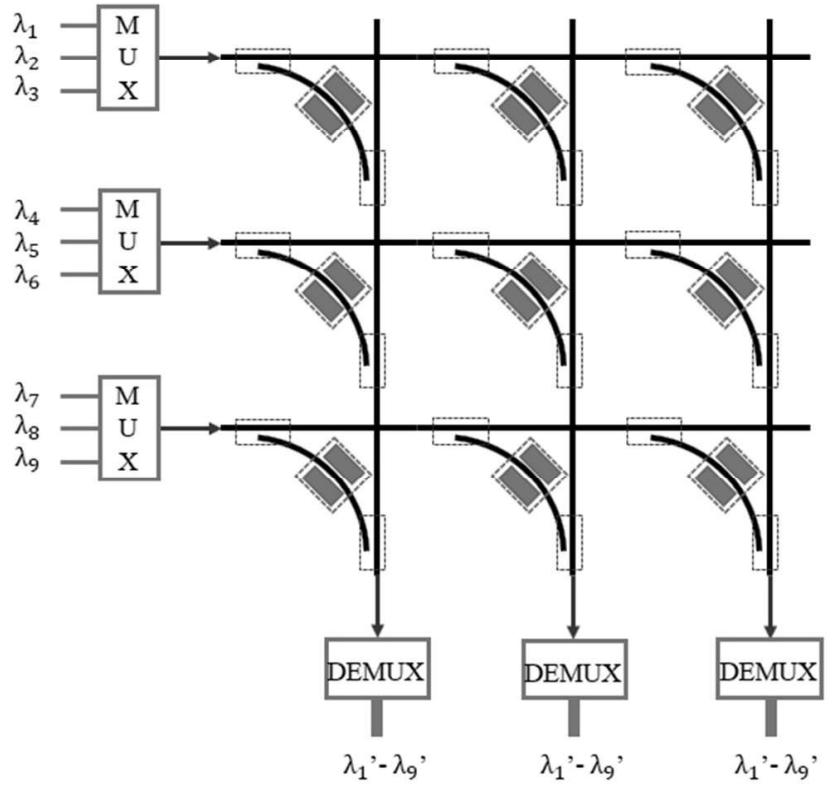

λ_1
λ_2
λ_3
MUX
λ_4
λ_5
λ_6
MUX
λ_7
λ_8
λ_9
MUX
DEMUX
DEMUX
DEMUX
λ_1'-λ_9'
λ_1'-λ_9'
λ_1'-λ_9'

Fig. 9

S1

Providing an optoelectronic hybrid computing unit, wherein the optoelectronic hybrid computing unit comprises a photonic computing unit and an optoelectronic conversion device that are interconnected; the photonic computing unit generates an optical output signal carrying encoded information; the optoelectronic conversion device converts the optical output signal into a current signal, and a magnitude of the current signal is proportional to a power of the optical output signal

Providing an electrical bus, wherein the electrical bus sums a corresponding number of current signals converted by a plurality of parallel-connected optoelectronic conversion devices, generating an electrical output signal, and the sum obtained by performing addition operation on the current signals is encoded into the electrical output signal

S2

Fig.10

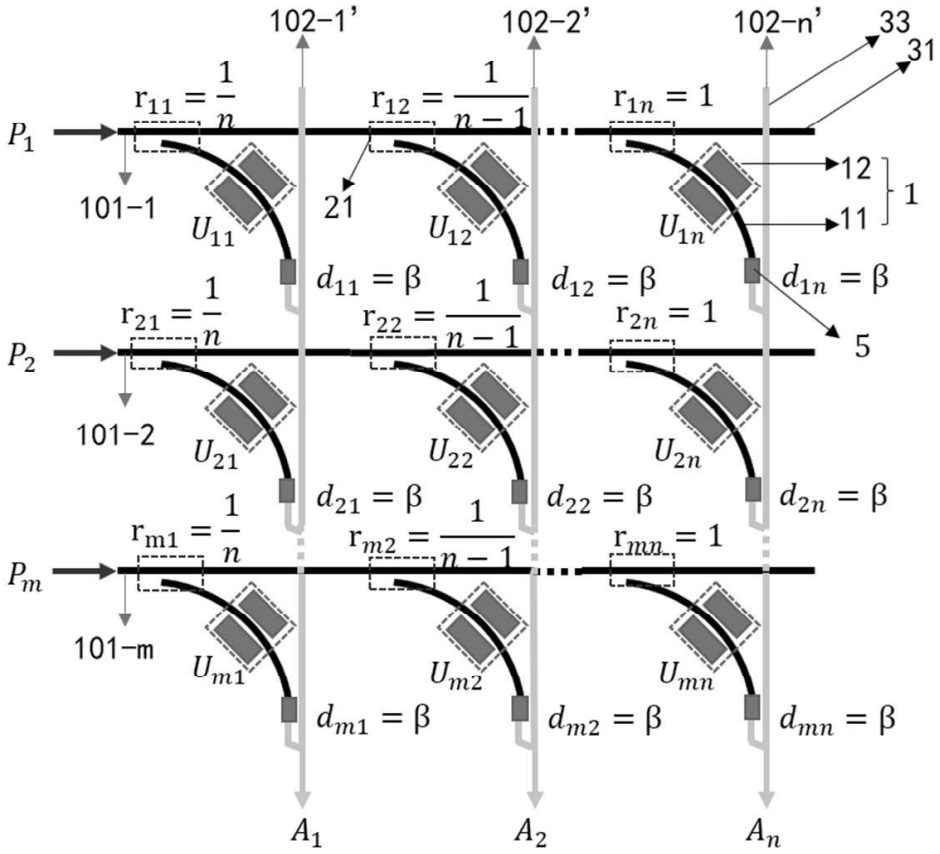


Fig.11

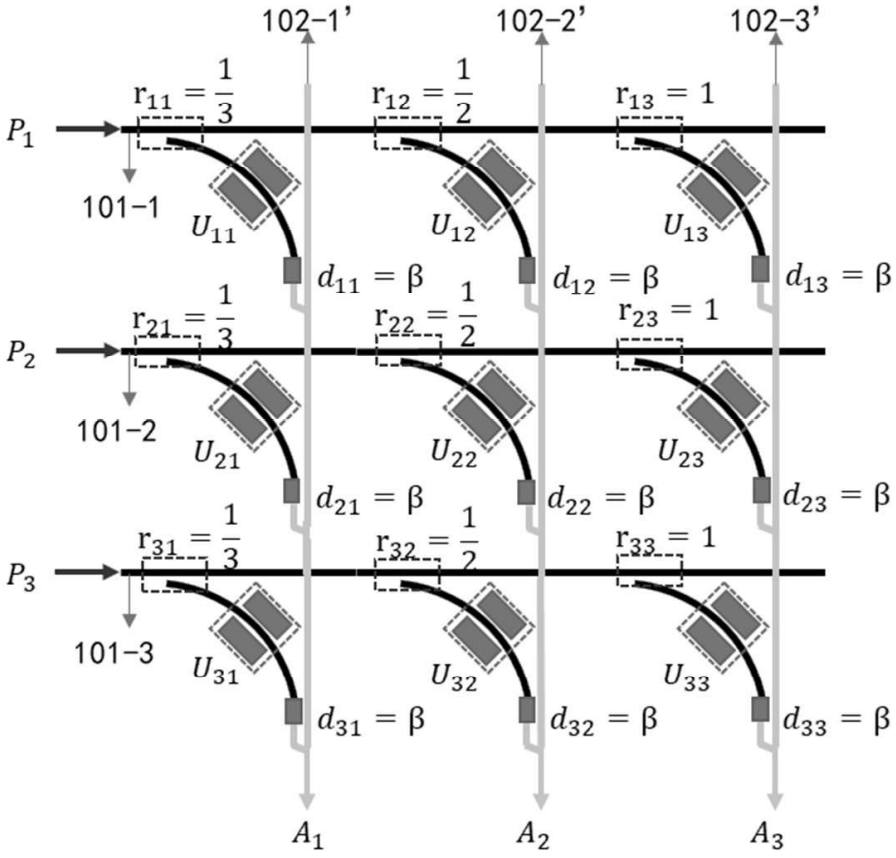

102-1'
102-2'
102-3'
$r_{11} = \frac{1}{3}$
$r_{12} = \frac{1}{2}$
$r_{13} = 1$
P_1
101-1
U_{11}
U_{12}
U_{13}
$d_{11} = \beta$
$d_{12} = \beta$
$d_{13} = \beta$
$r_{21} = \frac{1}{3}$
$r_{22} = \frac{1}{2}$
$r_{23} = 1$
P_2
101-2
U_{21}
U_{22}
U_{23}
$d_{21} = \beta$
$d_{22} = \beta$
$d_{23} = \beta$
$r_{31} = \frac{1}{3}$
$r_{32} = \frac{1}{2}$
$r_{33} = 1$
P_3
101-3
U_{31}
U_{32}
U_{33}
$d_{31} = \beta$
$d_{32} = \beta$
$d_{33} = \beta$
A_1
A_2
A_3

Fig.12

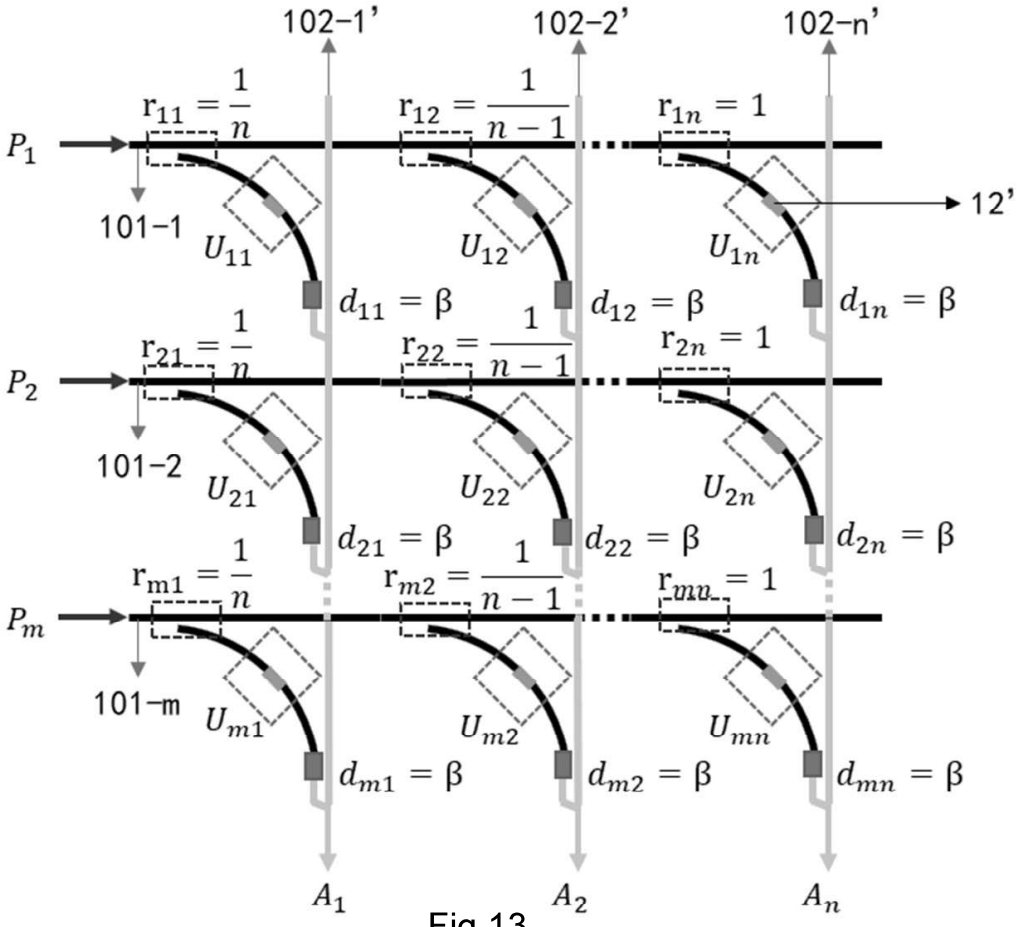

102-1'
102-2'
102-n'
$r_{11} = \frac{1}{n}$
$r_{12} = \frac{1}{n-1}$
$r_{1n} = 1$
P_1
101-1
U_{11}
U_{12}
U_{1n}
12'
$d_{11} = \beta$
$d_{12} = \beta$
$d_{1n} = \beta$
$r_{21} = \frac{1}{n}$
$r_{22} = \frac{1}{n-1}$
$r_{2n} = 1$
P_2
101-2
U_{21}
U_{22}
U_{2n}
$d_{21} = \beta$
$d_{22} = \beta$
$d_{2n} = \beta$
$r_{m1} = \frac{1}{n}$
$r_{m2} = \frac{1}{n-1}$
$r_{mn} = 1$
P_m
101-m
U_{m1}
U_{m2}
U_{mn}
$d_{m1} = \beta$
$d_{m2} = \beta$
$d_{mn} = \beta$
A_1
A_2
A_n

Fig.13

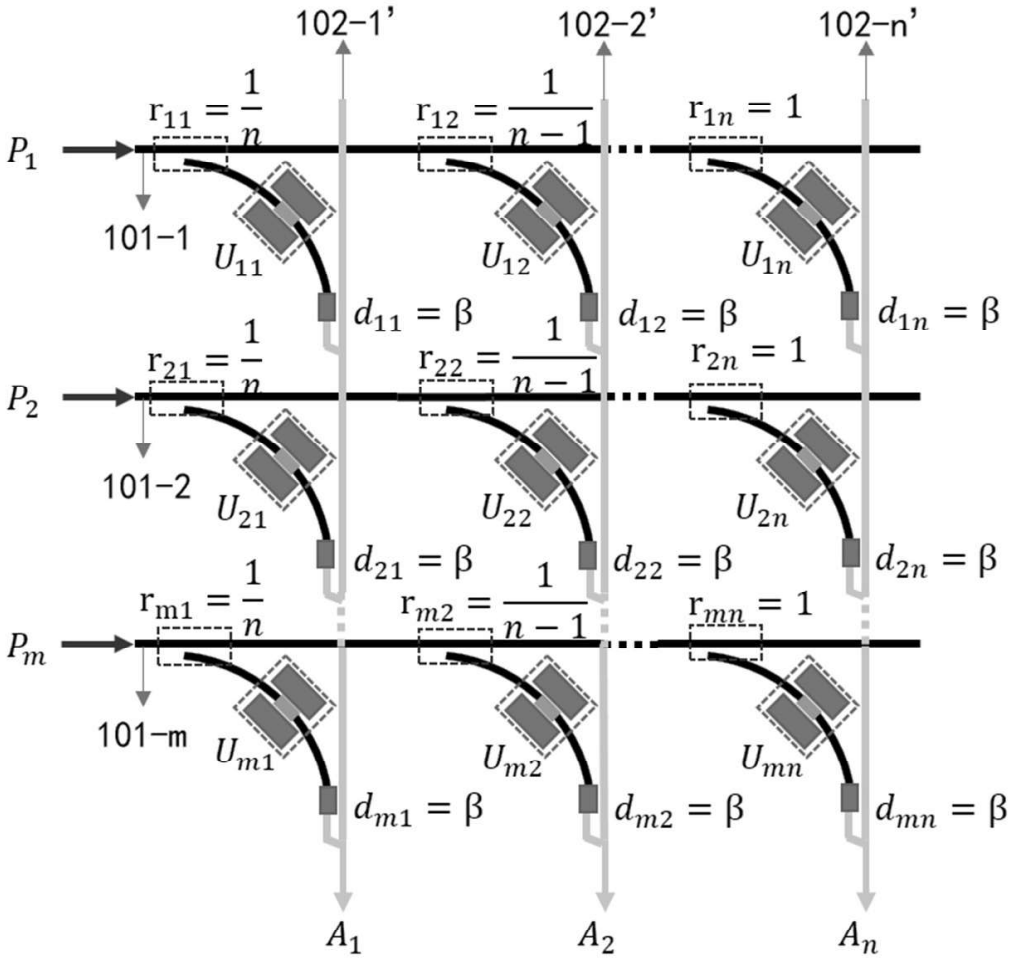

102−1'
102−2'
102−n'
$r_{11} = \frac{1}{n}$
$r_{12} = \frac{1}{n-1}$
$r_{1n} = 1$
P_1
101−1
U_{11}
U_{12}
U_{1n}
$d_{11} = \beta$
$d_{12} = \beta$
$d_{1n} = \beta$
$r_{21} = \frac{1}{n}$
$r_{22} = \frac{1}{n-1}$
$r_{2n} = 1$
P_2
101−2
U_{21}
U_{22}
U_{2n}
$d_{21} = \beta$
$d_{22} = \beta$
$d_{2n} = \beta$
$r_{m1} = \frac{1}{n}$
$r_{m2} = \frac{1}{n-1}$
$r_{mn} = 1$
P_m
101−m
U_{m1}
U_{m2}
U_{mn}
$d_{m1} = \beta$
$d_{m2} = \beta$
$d_{mn} = \beta$
A_1
A_2
A_n

Fig.14