CRISTALOGRAFIE:

C2: SIMETRIA PUNCTUALĂ

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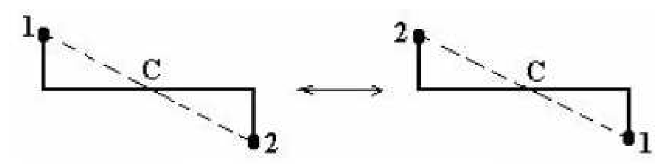
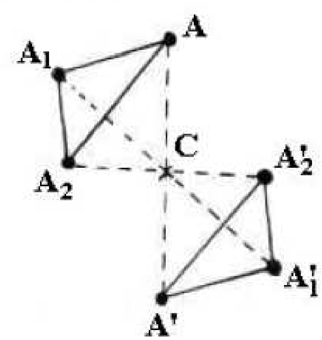
SIMETRIA CORPURILOR IZOLATE

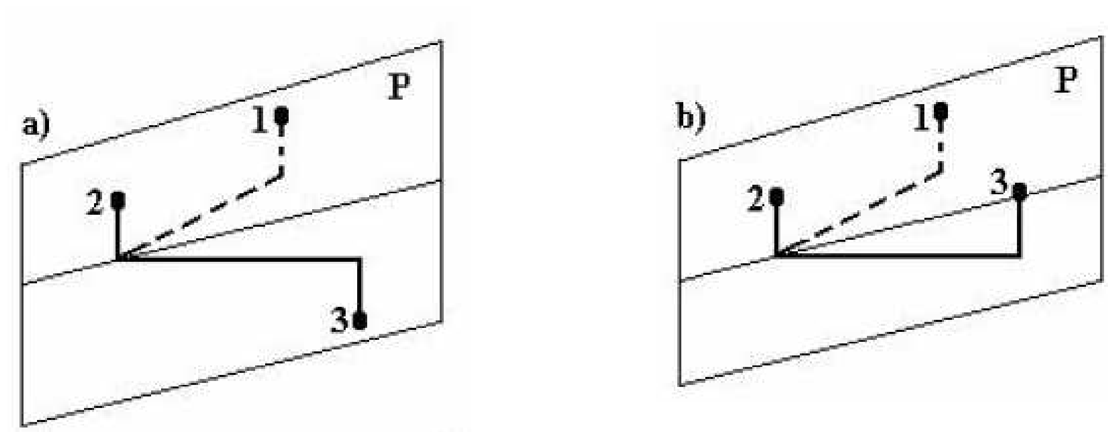
Simetria este proprietatea unui corp de ajunge într-o poziţie nediferenţiabilă faţă de cea iniţială atunci cînd a fost "mişcat" într-un fel anume.

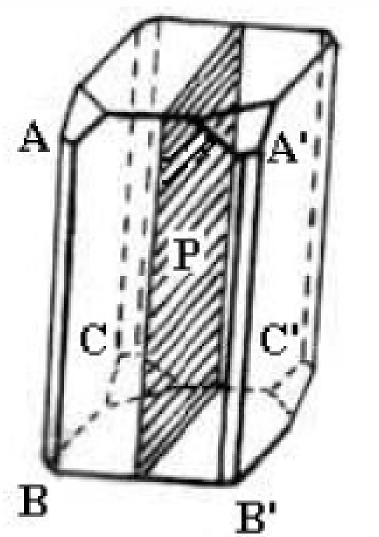
- punctul: *centrul de simetrie sau de inversie*;
- dreapta: *axe de simetrie sau de rotaţie*;
- planul: *plane de simetrie sau de oglindire*.





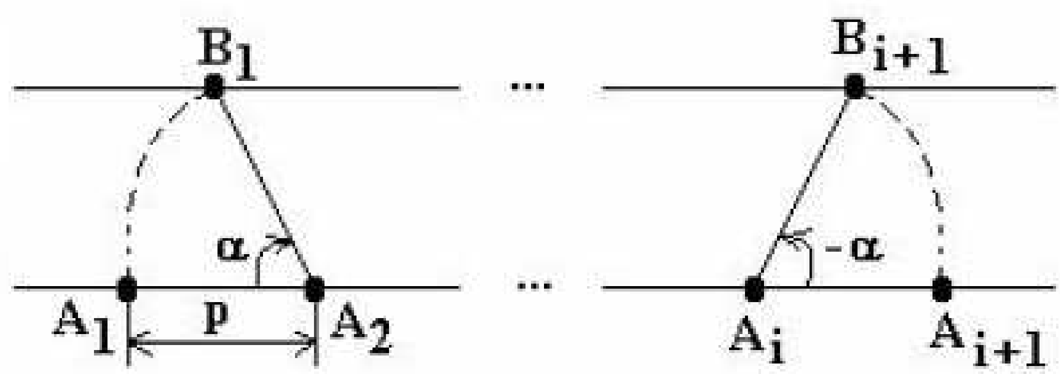
ilustrarea unui plan P de non-simetrie (a) şi de simetrie (b)





Construcția ajutătoare demonstrării tipurilor de axe de simetrie posibile într-un cristal.

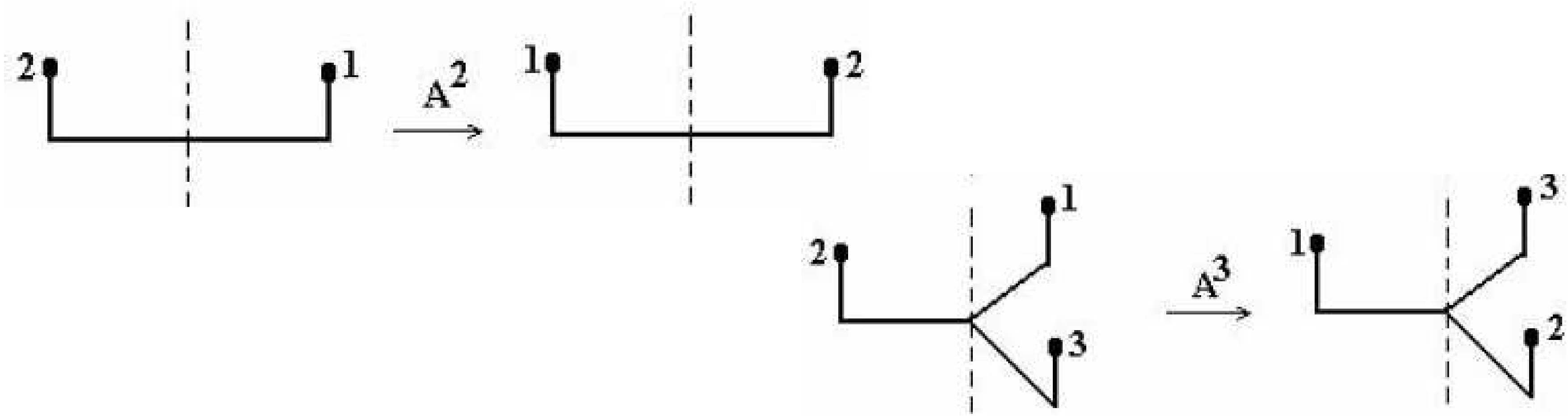
$B_1B_{i+1}=N_1p$



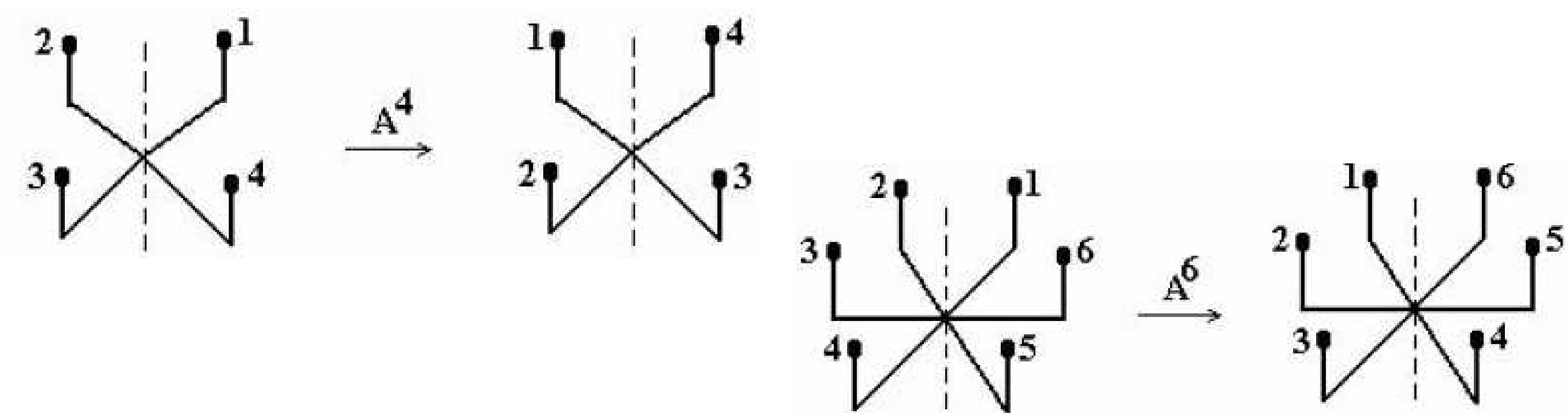
$A_2A_i=N_2p$

$$B_1B_{i+1}=A_2A_i + 2p\cos\alpha \qquad \cos\alpha = \frac{N_1 - N_2}{2} = k\frac{1}{2}$$

$\cos\alpha = -1$	$\Rightarrow$	$2\pi/n = \pi$	$\Rightarrow$	$n = 2$
$\cos\alpha = -1/2$	$\Rightarrow$	$2\pi/n = 2\pi/3$	$\Rightarrow$	$n = 3$
$\cos\alpha = 0$	$\Rightarrow$	$2\pi/n = \pi/2$	$\Rightarrow$	$n = 4$
$\cos\alpha = ½$	$\Rightarrow$	$2\pi/n = \pi/3$	$\Rightarrow$	$n = 6$
$\cos\alpha = 1$	$\Rightarrow$	$2\pi/n = 2\pi$	$\Rightarrow$	$n = 1$

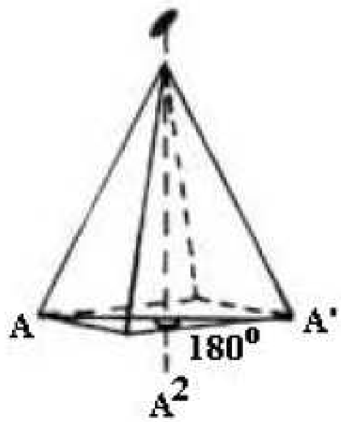


Ilustrarea operațiilor de rotație permise într-un cristal.

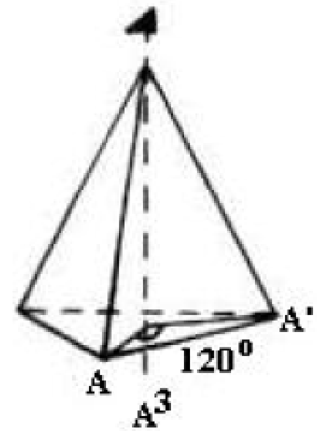


Ilustrarea acțiunii girelor A^2, A^3, A^4, și A^6 asupra corpurilor izolate.

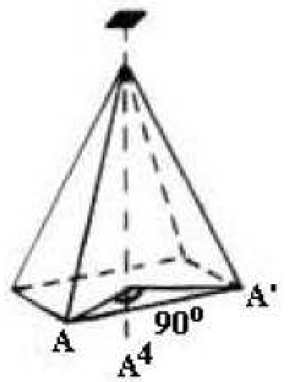
A^2:



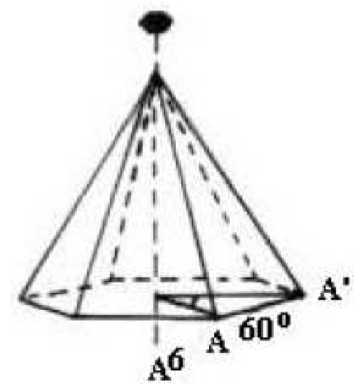
A^3:

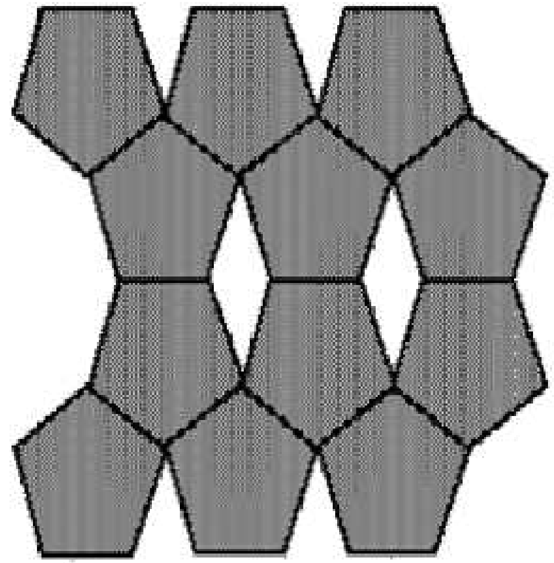


A^4:



A^6:





Inversia, rotația şi reflexia sunt operații de simetrie simple; fiecare din ele se execută în raport cu un singur element de simetrie.Un poliedru cristalin poate avea mai multe axe, mai multe plane, dar un singur centru de inversie.

Numărul şi tipul elementelor de simetrie ce caracterizează un poliedru cristalin nu sunt întâmplătoare deoarece asocierea elementelor de simetrie are un caracter legic. Acest lucru va fi ilustrat în continuare.

$$A^n + C \Rightarrow A^n C \Pi \quad , n=2k$$

$$A^n + \Pi \Rightarrow A^n \Pi C \quad , n=2k$$

$$A^n + C \Rightarrow A^n C \quad , n=2k+1$$

$$A^n + \Pi \Rightarrow A^n \Pi \quad , n=2k+1$$

$$A^n + A^2 \Rightarrow A^n nA^2$$

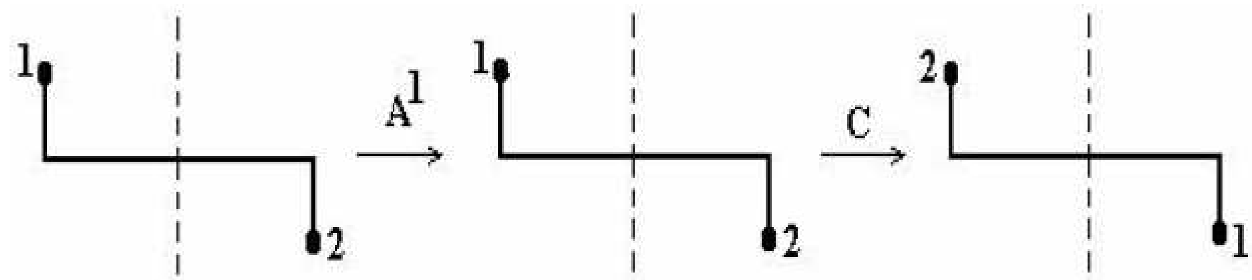
$$A^n + P \Rightarrow A^n nP$$

Combinarea a două operații simple de simetrie conduce la definirea elementelor complexe de simetrie. Pentru poliedrul izolat se pot defini următoarele combinații:

- rotație + reflexie;
- rotație + inversie;
- inversie + reflexie.

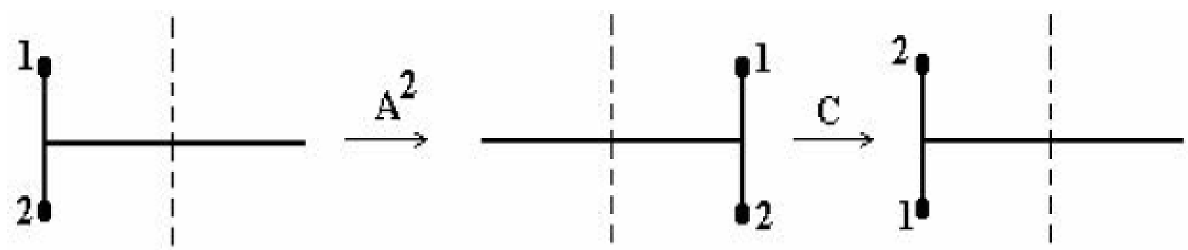
(A_i^1)

$A_i^1 = C$



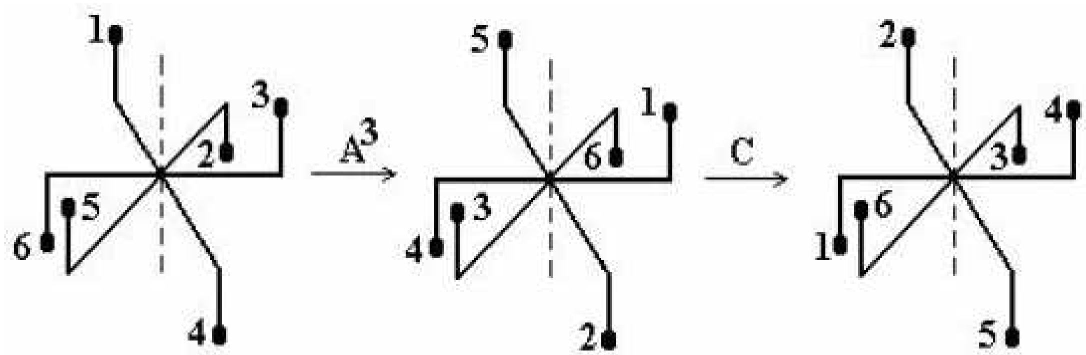
(A_i^2)

$A_i^2 = \Pi\ (P)$

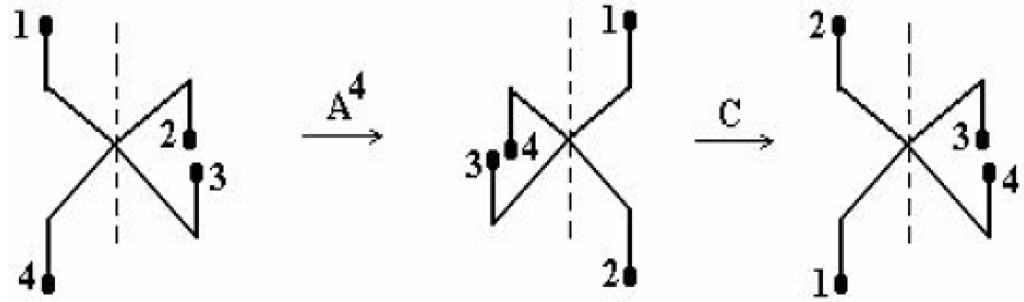


(A_i^3)

$A_i^3 = A^3C$

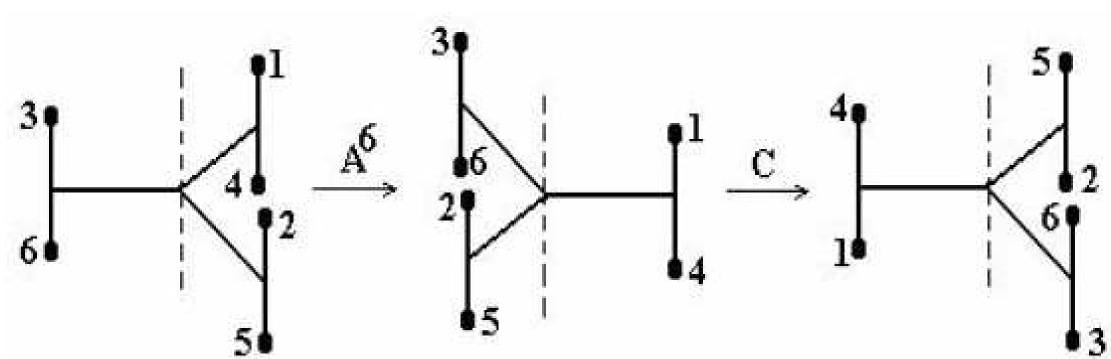


(A_i^4)



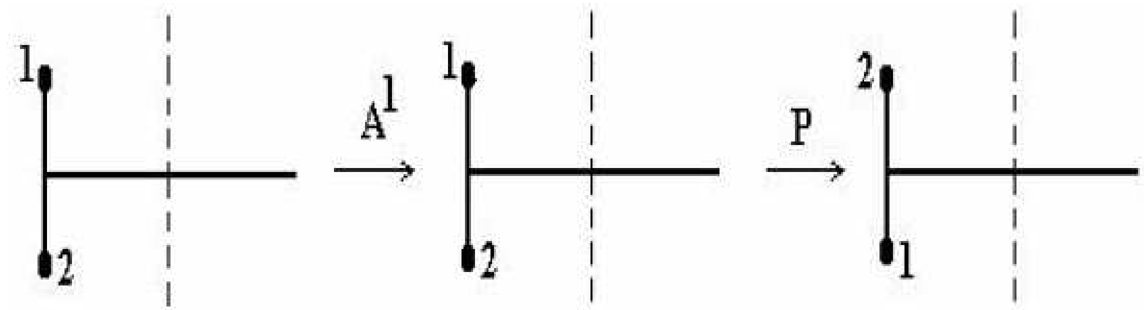
(A_i^6)

$A_i^6 = A^3\Pi$



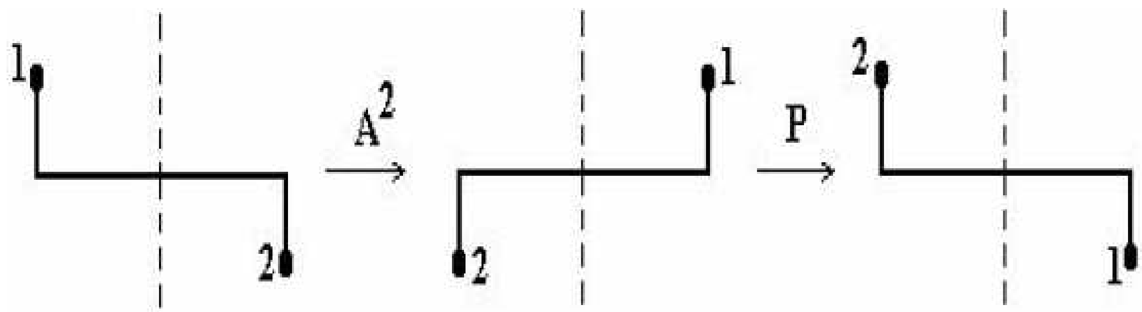
(A_1)

$A_1 = P\ (\Pi)$



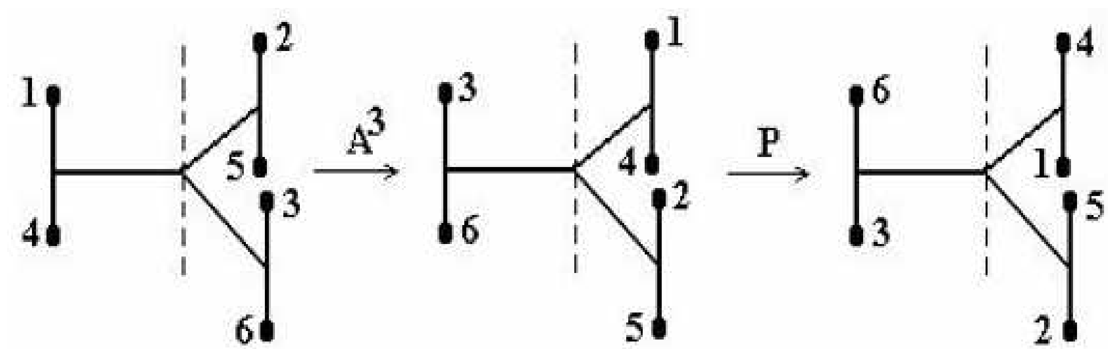
(A_2)

$A_2 = C$

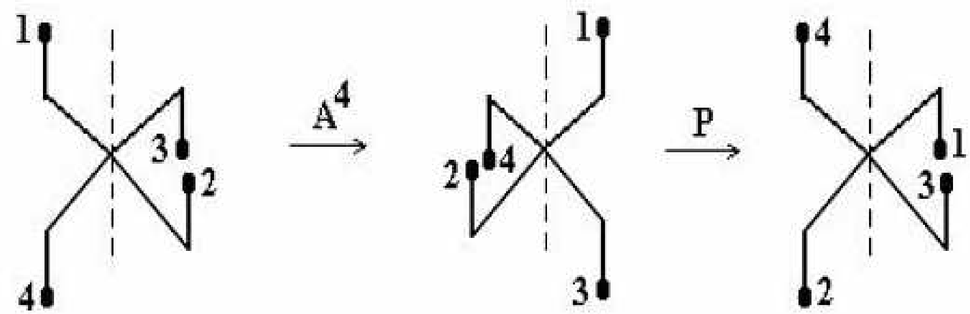


(A_3)

$A_3 = A^3\ \Pi$

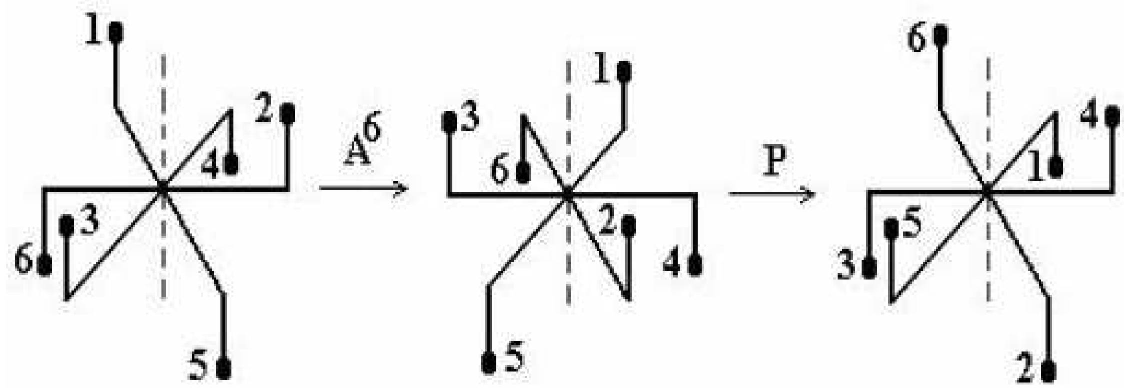


(A_4)



(A_6)

$A_6 = A^3C$



$$A_i^1 = A_2 = C$$
$$A_i^2 = A_1 = P$$
$$A_i^3 = A_6 = A^3C$$
$$A_i^6 = A_3 = A^3\Pi$$