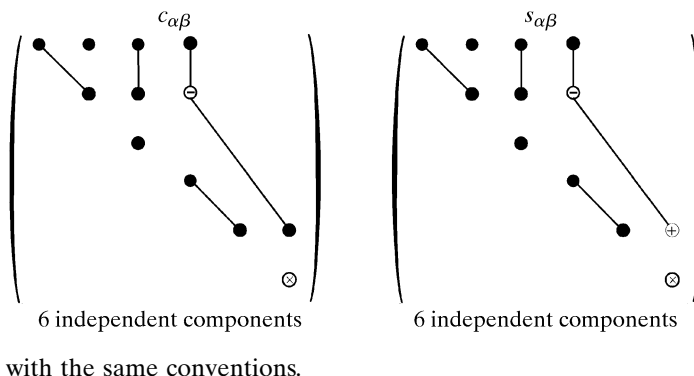
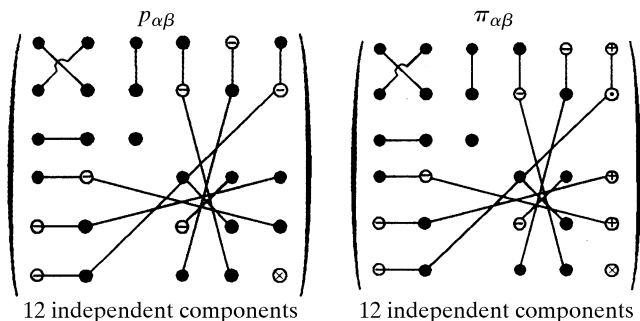


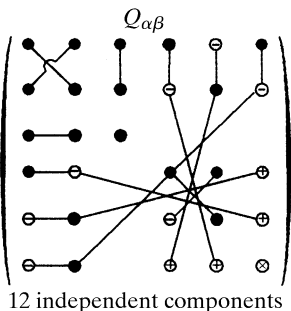
1. TENSORIAL ASPECTS OF PHYSICAL PROPERTIES

1.1.4.10.6.4. *Trigonal system*

(i) Groups 3, $\bar{3}$:

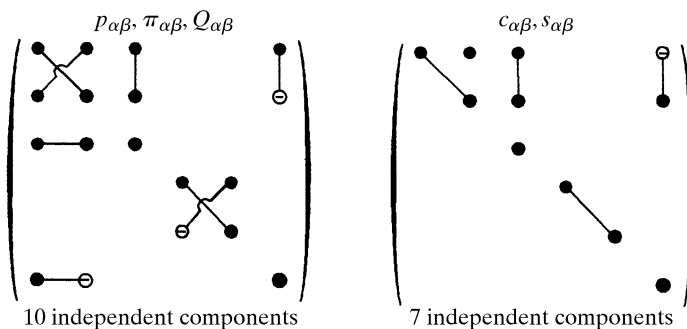
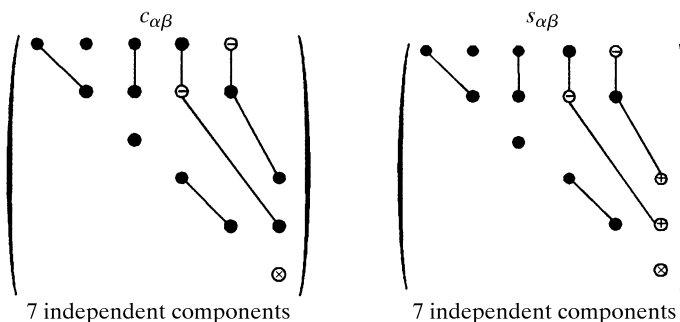


with the same conventions.

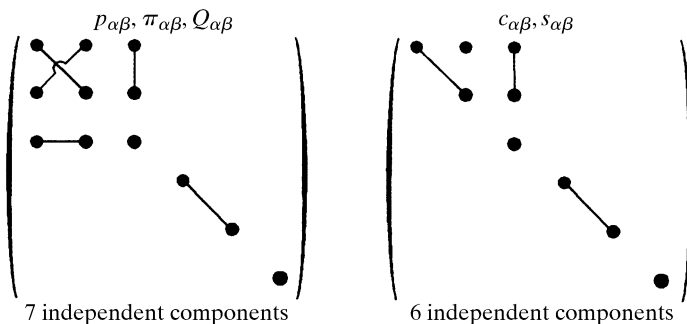


1.1.4.10.6.5. *Tetragonal system*

(i) Groups 4, $\bar{4}$ and 4/m:

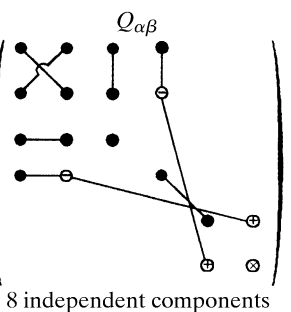
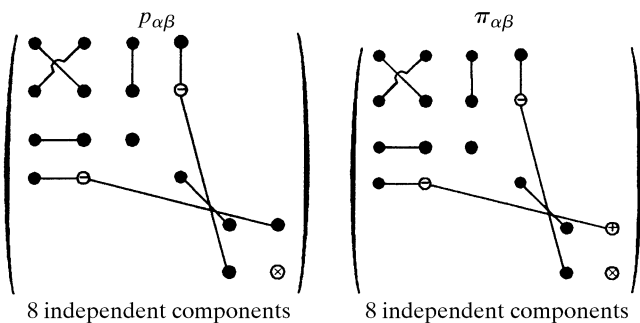


(ii) Groups 422, 4mm, $\bar{4}2m$ and 4/mmm:



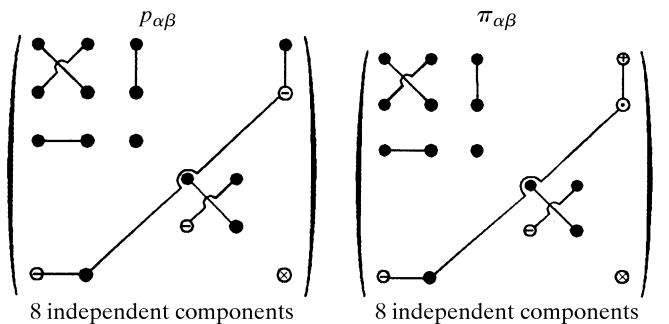
where \ominus is a component numerically equal but opposite in sign to the heavy dot component to which it is linked; \oplus is a component equal to twice the heavy dot component to which it is linked; \odot is a component equal to minus twice the heavy dot component to which it is linked; \otimes is equal to $1/2(p_{11} - p_{12})$, $(\pi_{11} - \pi_{12})$, $2(Q_{11} - Q_{12})$, $1/2(c_{11} - c_{12})$ and $2(s_{11} - s_{12})$, respectively.

(ii) Groups 32, 3m, $\bar{3}m$:

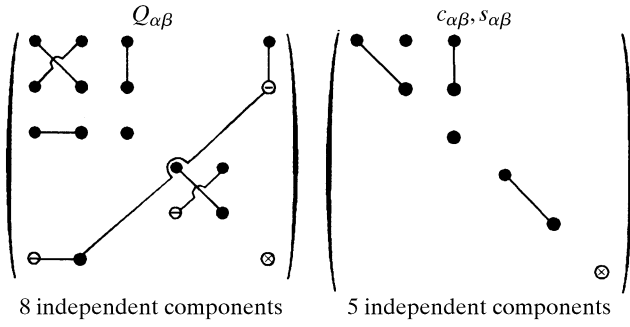


1.1.4.10.6.6. *Hexagonal system*

(i) Groups 6, $\bar{6}$ and 6/m:

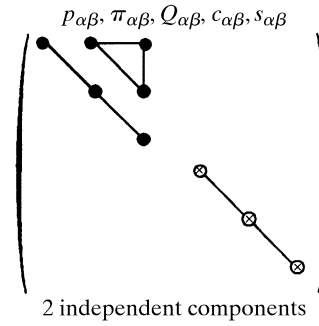


1.1. INTRODUCTION TO THE PROPERTIES OF TENSORS

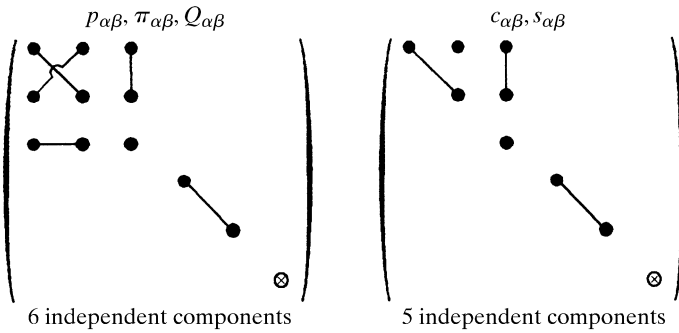


1.1.4.10.6.8. Spherical system

For all tensors



(ii) Groups 622, 6mm, $\bar{6}2m$ and 6/mmm:



1.1.4.10.7. Reduction of the number of independent components of axial tensors of rank 2

It was shown in Section 1.1.4.5.3.2 that axial tensors of rank 2 are actually tensors of rank 3 antisymmetric with respect to two indices. The matrix of independent components of a tensor such that

$$g_{ijk} = -g_{jik}$$

is given by

$$\left(\begin{array}{ccc|ccc|cc} & 122 & 133 & 123 & 131 & & 132 & & 121 \\ -121 & & 223 & & 231 & -122 & 232 & -123 & \\ -131 & -232 & & -233 & & -132 & & -133 & -231 \end{array} \right).$$

The second-rank axial tensor g_{kl} associated with this tensor is defined by

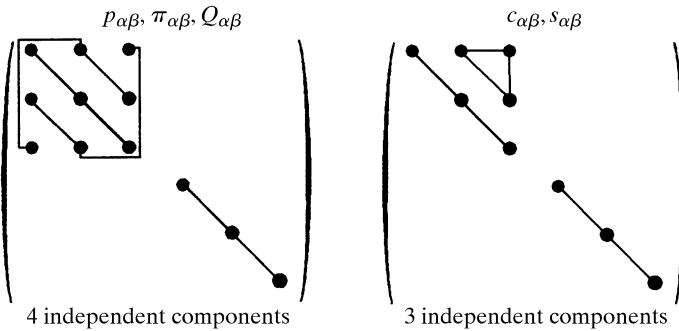
$$g_{kl} = \frac{1}{2} \epsilon_{ijk} g_{ijl}$$

For instance, the piezomagnetic coefficients that give the magnetic moment M_i due to an applied stress T_α are the components of a second-rank axial tensor, $\Lambda_{i\alpha}$ (see Section 1.5.7.1):

$$M_i = \Lambda_{i\alpha} T_\alpha$$

1.1.4.10.6.7. Cubic system

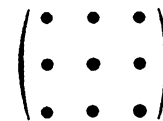
(i) Groups 23 and 3m:



1.1.4.10.7.1. Independent components according to the following point groups

(i) Triclinic system

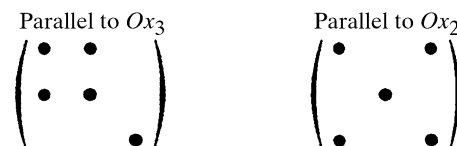
(a) Group 1:



(b) Group $\bar{1}$: all components are equal to zero.

(ii) Monoclinic system

(a) Group 2:



(ii) Groups 432, $\bar{4}3m$ and $m\bar{3}m$:

