Universidad Industrial de Santander

Redes de Bravais

Métodos matemáticos para fisicos I
Profesor: Luis Nuñez

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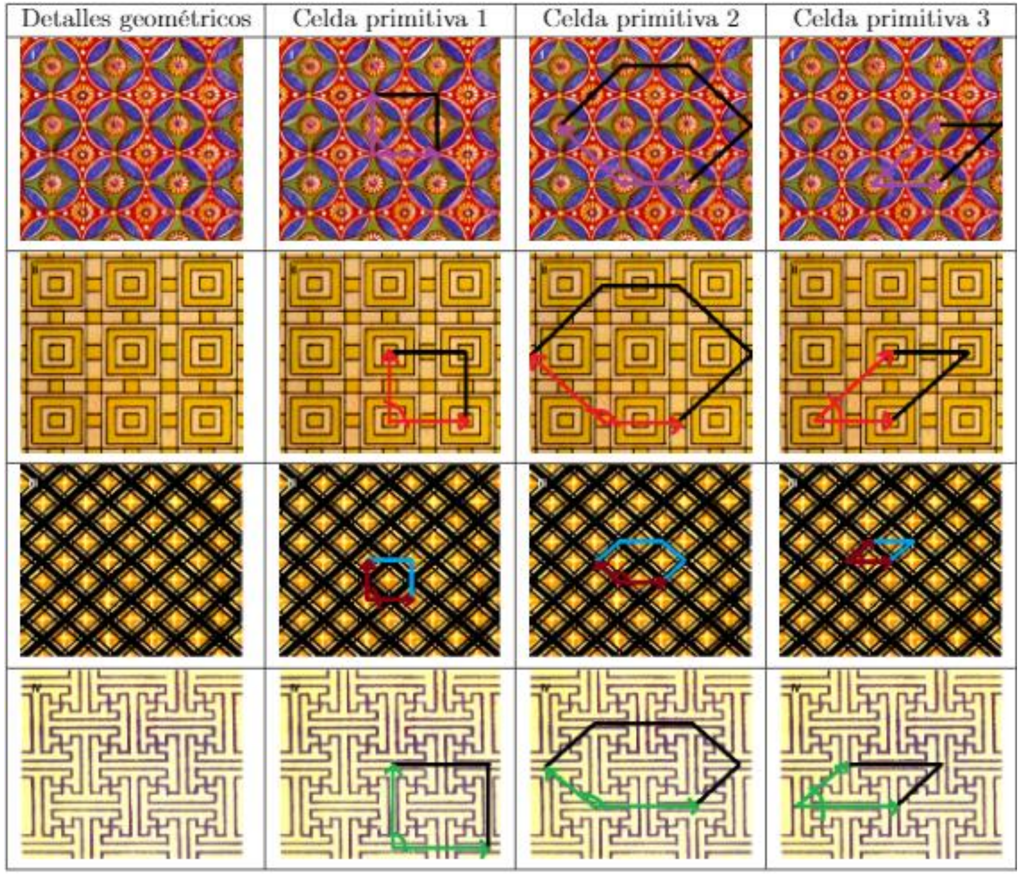
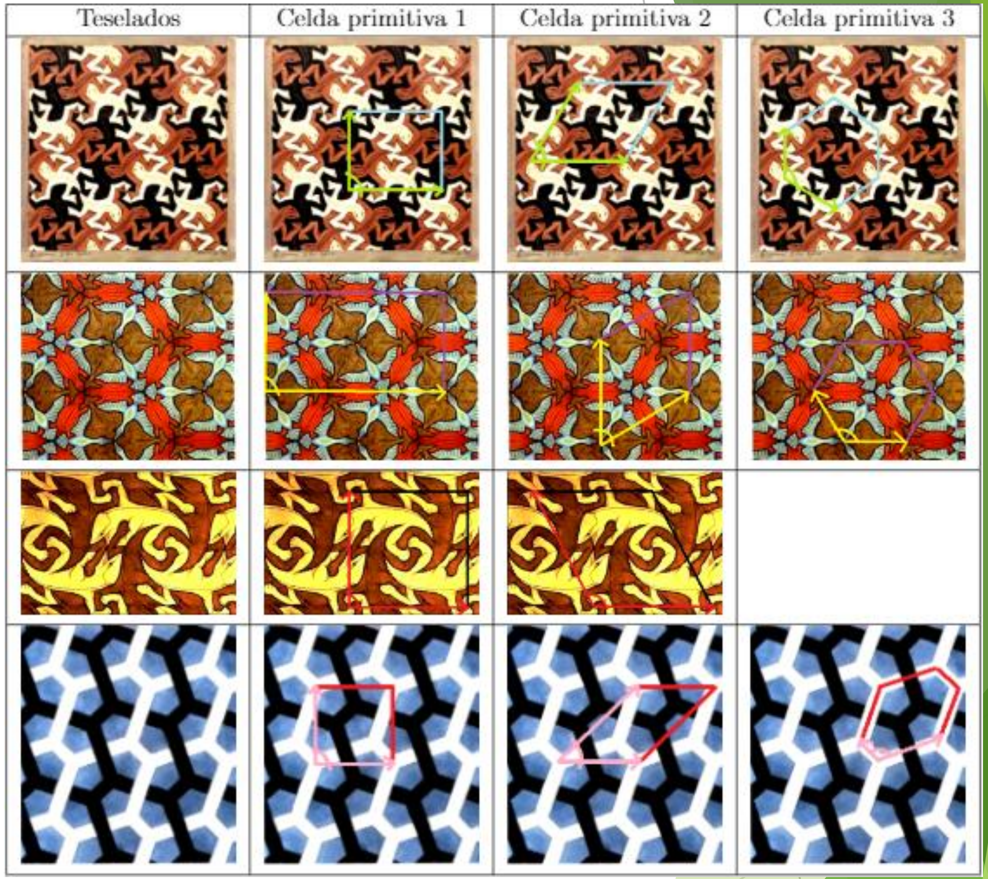
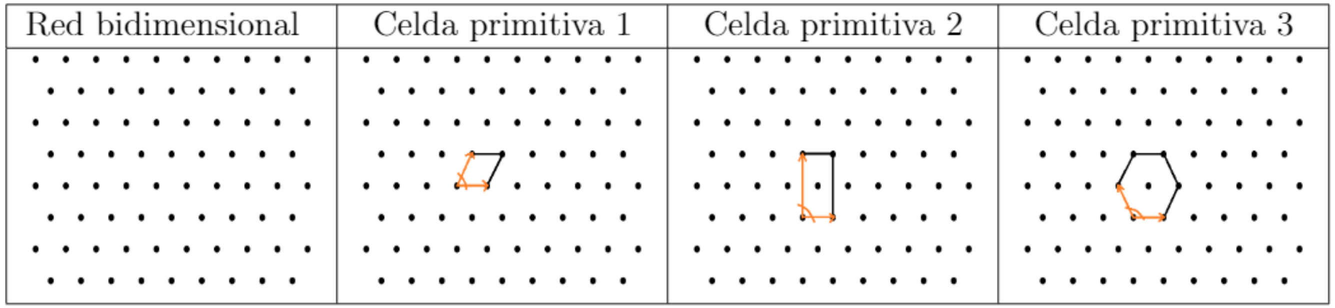
Inciso a

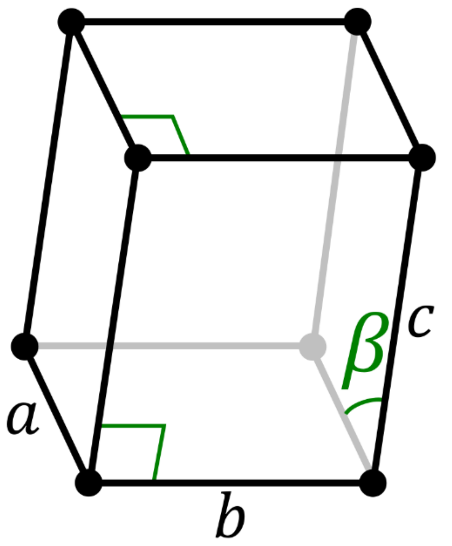

Detalles geométricos
Celda primitiva 1
Celda primitiva 2
Celda primitiva 3


Teselados
Celda primitiva 1
Celda primitiva 2
Celda primitiva 3


Red bidimensional
Celda primitiva 1
Celda primitiva 2
Celda primitiva 3

Inciso b

Monoclínico



|a|≠|b|≠|c| y α=γ=90°
β< 90°

$$\boldsymbol{a} = (a1, a2, a3), \qquad \boldsymbol{b} = (b1, b2, b3), \qquad \boldsymbol{c} = (c1, c2, c3)$$

$$v = \boldsymbol{c} * (\boldsymbol{a}x\boldsymbol{b}) = \begin{vmatrix} c1 & c2 & c3 \\ a1 & a2 & a3 \\ b1 & b2 & b3 \end{vmatrix}$$

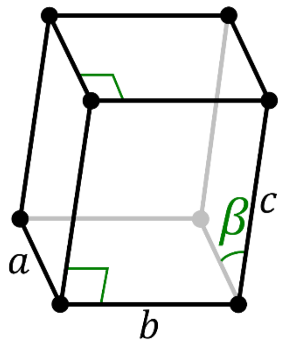
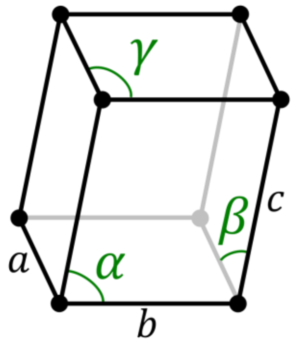
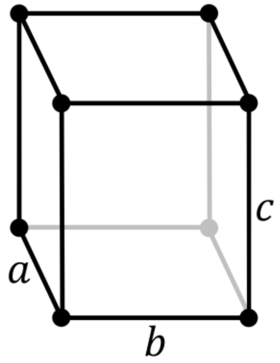
$$v^2 = Det(\boldsymbol{DD}^T) = \begin{vmatrix} \boldsymbol{c}.\boldsymbol{c} & \boldsymbol{c}.\boldsymbol{a} & \boldsymbol{c}.\boldsymbol{b} \\ \boldsymbol{c}.\boldsymbol{a} & \boldsymbol{a}.\boldsymbol{a} & \boldsymbol{a}.\boldsymbol{b} \\ \boldsymbol{c}.\boldsymbol{b} & \boldsymbol{a}.\boldsymbol{b} & \boldsymbol{b}.\boldsymbol{b} \end{vmatrix}$$

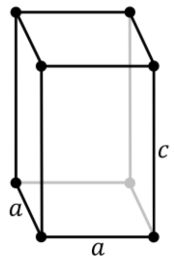
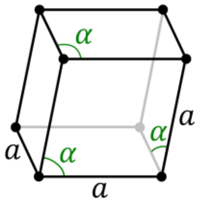
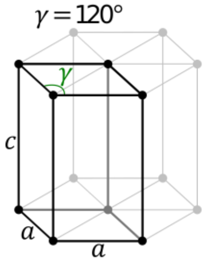
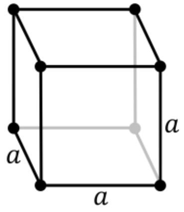
$$v^2 = Det(\boldsymbol{DD}^T) = (\mathbf{c}.\mathbf{d})((\mathbf{a}.\mathbf{a})(\mathbf{b}.\mathbf{b}) - (\mathbf{a}.\mathbf{b})^2) - (\mathbf{c}.\mathbf{a})((\mathbf{c}.\mathbf{a})(\mathbf{b}.\mathbf{b}) - (\mathbf{a}.\mathbf{b})(\mathbf{c}.\mathbf{b})) + (\boldsymbol{c}.\boldsymbol{b})((\boldsymbol{c}.\boldsymbol{a})(\boldsymbol{a}.\boldsymbol{b}) - (\boldsymbol{a}.\boldsymbol{a})(\boldsymbol{c}.\boldsymbol{b}))$$

$$v = |\boldsymbol{a}||\boldsymbol{b}||\boldsymbol{c}|\sqrt{1 - \cos^2\gamma - \cos^2\beta - \cos^2\alpha + 2cos\gamma cos\beta cos\alpha}$$

$$v = |\boldsymbol{a}||\boldsymbol{b}||\boldsymbol{c}|\sqrt{1 - \cos^2\beta}$$

$$v = |\boldsymbol{a}||\boldsymbol{b}||\boldsymbol{c}|sin\beta$$

Monoclínica		$v = \lvert\boldsymbol{a}\rvert\lvert\boldsymbol{b}\rvert\lvert\boldsymbol{c}\rvert sin\beta$
Triclínica		$v = \lvert\boldsymbol{a}\rvert\lvert\boldsymbol{b}\rvert\lvert\boldsymbol{c}\rvert$ $\sqrt{1-\cos^2\alpha-\cos^2\beta-\cos^2\gamma+2cos\alpha cos\gamma cos\beta}$
Ortorrómbica		$v = \lvert\boldsymbol{a}\rvert\lvert\boldsymbol{b}\rvert\lvert\boldsymbol{c}\rvert$

Tetragonal		$v = \lvert\boldsymbol{a}\rvert^2 \lvert\boldsymbol{c}\rvert$
Romboédrico		$v = \lvert\boldsymbol{a}\rvert^3 \sqrt{1 - 3\cos^2\alpha + 2\cos^3\alpha}$
Hexagonal		$v = \lvert\boldsymbol{a}\rvert^2 \lvert\boldsymbol{c}\rvert \dfrac{\sqrt{3}}{2}$
Cúbico		$v = \lvert\boldsymbol{a}\rvert^3$

Inciso c

Parte I: BCC $\boldsymbol{a} = a\hat{\boldsymbol{\imath}}, \boldsymbol{b} = a\hat{\boldsymbol{\jmath}}, \boldsymbol{c} = a(\hat{\boldsymbol{\imath}} + \hat{\boldsymbol{\jmath}} + \widehat{\boldsymbol{k}})/\mathbf{2}$

$$\mathbf{c}\cdot(\mathbf{a}\times\mathbf{b}) = \begin{vmatrix} c_1 & c_2 & c_3 \\ a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \end{vmatrix} = \begin{vmatrix} \frac{a}{2} & \frac{a}{2} & \frac{a}{2} \\ a & 0 & 0 \\ 0 & a & 0 \end{vmatrix} = \frac{a^3}{2}$$

Parte II: BCC $\boldsymbol{a} = a(\hat{\boldsymbol{\jmath}} + \widehat{\boldsymbol{k}} - \hat{\boldsymbol{\imath}})/\mathbf{2}, \boldsymbol{b} = a(\hat{\boldsymbol{\imath}} + \widehat{\boldsymbol{k}} - \hat{\boldsymbol{\jmath}})/\mathbf{2}, \boldsymbol{c} = a(\hat{\boldsymbol{\imath}} + \hat{\boldsymbol{\jmath}} - \widehat{\boldsymbol{k}})/\mathbf{2}$

$$\mathbf{c}\cdot(\mathbf{a}\times\mathbf{b}) = \begin{vmatrix} c_1 & c_2 & c_3 \\ a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \end{vmatrix} = \begin{vmatrix} \frac{a}{2} & \frac{a}{2} & -\frac{a}{2} \\ -\frac{a}{2} & \frac{a}{2} & \frac{a}{2} \\ \frac{a}{2} & -\frac{a}{2} & \frac{a}{2} \end{vmatrix} = \frac{a^3}{2}$$

Parte III: FCC $\boldsymbol{a} = a(\hat{\boldsymbol{\jmath}} + \widehat{\boldsymbol{k}})/\mathbf{2}, \boldsymbol{b} = a(\hat{\boldsymbol{\imath}} + \widehat{\boldsymbol{k}})/\mathbf{2}, \boldsymbol{c} = a(\hat{\boldsymbol{\imath}} + \hat{\boldsymbol{\jmath}})/\mathbf{2}$

$$\mathbf{c}\cdot(\mathbf{a}\times\mathbf{b}) = \begin{vmatrix} c_1 & c_2 & c_3 \\ a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \end{vmatrix} = \begin{vmatrix} \frac{a}{2} & \frac{a}{2} & 0 \\ 0 & \frac{a}{2} & \frac{a}{2} \\ \frac{a}{2} & 0 & \frac{a}{2} \end{vmatrix} = \frac{a^3}{4}$$

$\boldsymbol{a} = a\hat{\boldsymbol{\imath}}, \boldsymbol{b} = a\hat{\boldsymbol{\jmath}}, \boldsymbol{c} = a\widehat{\boldsymbol{k}}$	$\mathbf{c}' \cdot (\mathbf{a}' \times \mathbf{b}') = \mathrm{V} = \frac{1}{a^3}$
$\boldsymbol{a} = a\hat{\boldsymbol{\imath}}, \boldsymbol{b} = a\hat{\boldsymbol{\jmath}},$ $\boldsymbol{c} = a(\hat{\boldsymbol{\imath}} + \hat{\boldsymbol{\jmath}} + \widehat{\boldsymbol{k}})/2$	$\mathbf{c}' \cdot (\mathbf{a}' \times \mathbf{b}') = \mathrm{V} = \frac{2}{a^3}$
$\boldsymbol{a} = \frac{a(\hat{\boldsymbol{\jmath}} + \widehat{\boldsymbol{k}} - \hat{\boldsymbol{\imath}})}{2},$ $\boldsymbol{b} = \frac{a(\hat{\boldsymbol{\imath}} + \widehat{\boldsymbol{k}} - \hat{\boldsymbol{\jmath}})}{2},$ $\boldsymbol{c} = a(\hat{\boldsymbol{\imath}} + \hat{\boldsymbol{\jmath}} - \widehat{\boldsymbol{k}})/2$	$\mathbf{c}' \cdot (\mathbf{a}' \times \mathbf{b}') = \mathrm{V} = \frac{2}{a^3}$
$\boldsymbol{a} = \frac{a(\hat{\boldsymbol{\jmath}} + \widehat{\boldsymbol{k}})}{2}, \boldsymbol{b} = \frac{a(\hat{\boldsymbol{\imath}} + \widehat{\boldsymbol{k}})}{2},$ $\boldsymbol{c} = a(\hat{\boldsymbol{\imath}} + \hat{\boldsymbol{\jmath}})/2$	$\mathbf{c}' \cdot (\mathbf{a}' \times \mathbf{b}') = \mathrm{V} = \frac{4}{a^3}$