Universidad Industrial de Santander

Redes de Bravais

Métodos matemáticos para fisicos I

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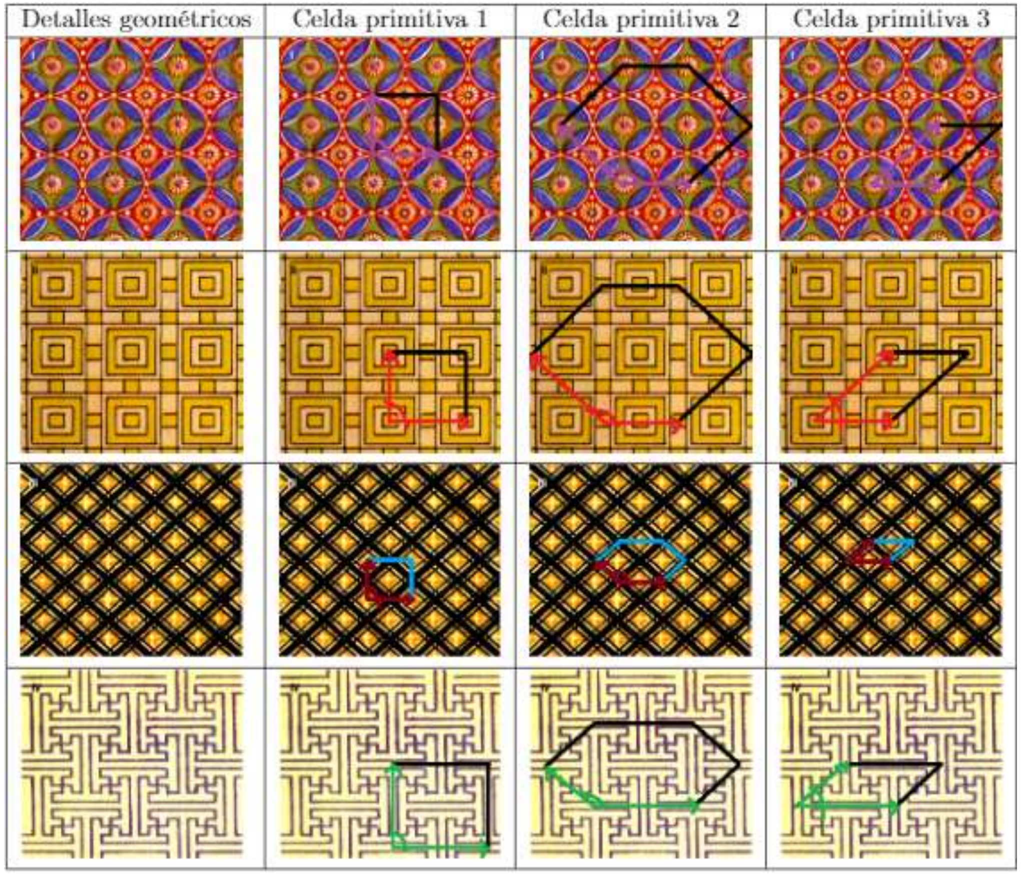
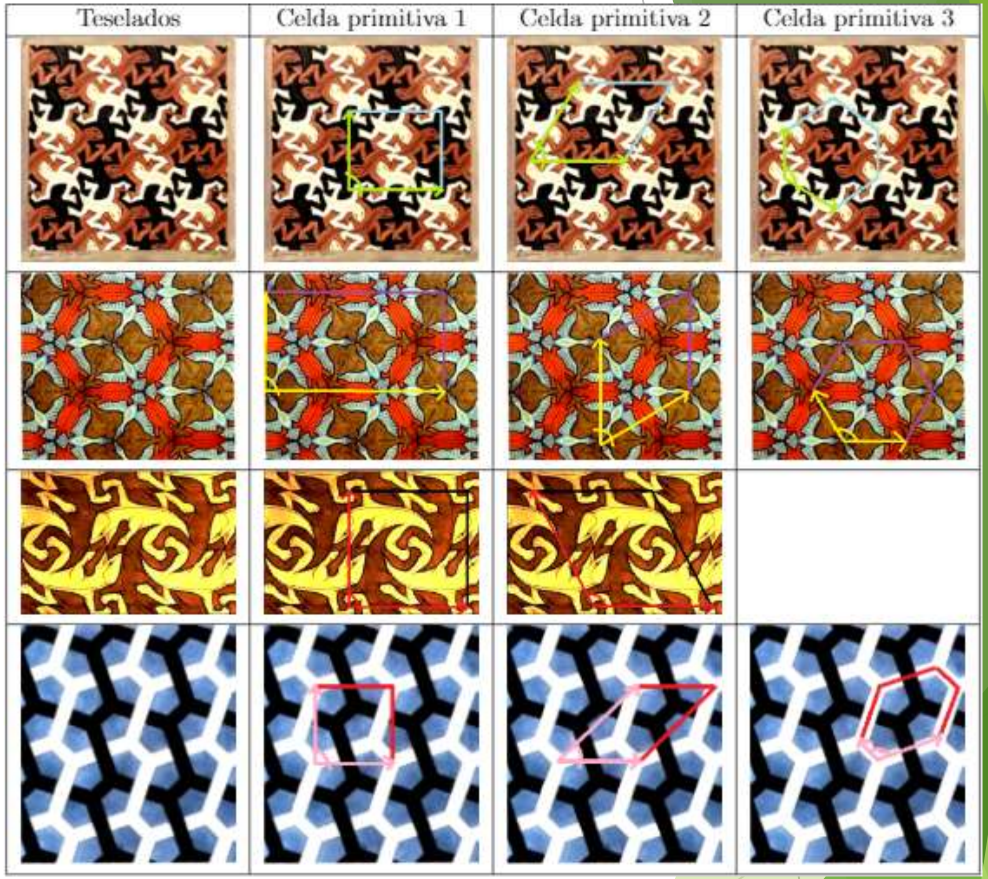
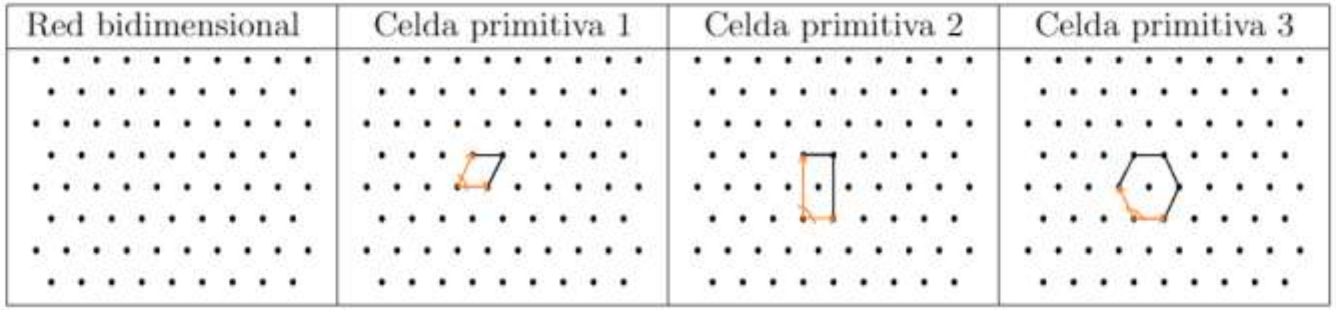
Inciso a



Detalles geométricos
Celda primitiva 1
Celda primitiva 2
Celda primitiva 3



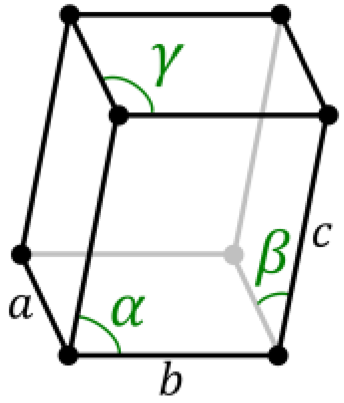
Teselados
Celda primitiva 1
Celda primitiva 2
Celda primitiva 3



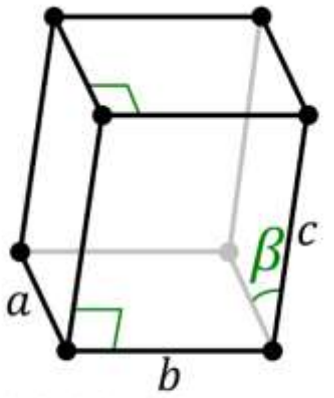
Red bidimensional
Celda primitiva 1
Celda primitiva 2
Celda primitiva 3

Inciso b

Triclínica



Monoclínica



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

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

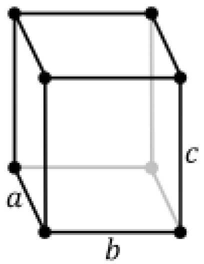
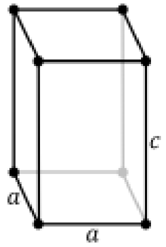
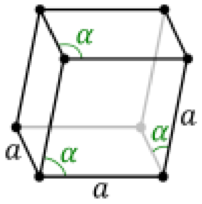
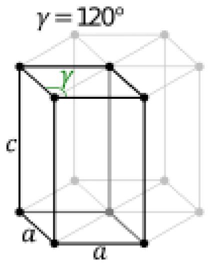
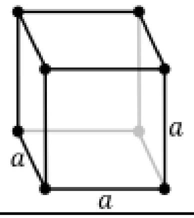
$$v^2 = Det(\boldsymbol{D}\boldsymbol{D}^T) = \begin{vmatrix} \boldsymbol{c.c} & \boldsymbol{c.a} & \boldsymbol{c.b} \\ \boldsymbol{c.a} & \boldsymbol{a.a} & \boldsymbol{a.b} \\ \boldsymbol{c.b} & \boldsymbol{a.b} & \boldsymbol{b.b} \end{vmatrix}$$

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

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

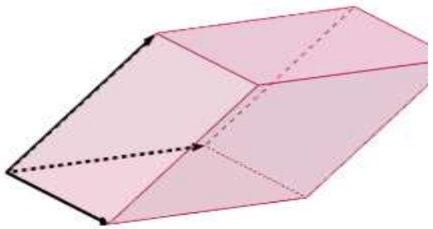
$$v = |\boldsymbol{a}||\boldsymbol{b}||\boldsymbol{c}|\sqrt{1 - \cos^2\beta}$$

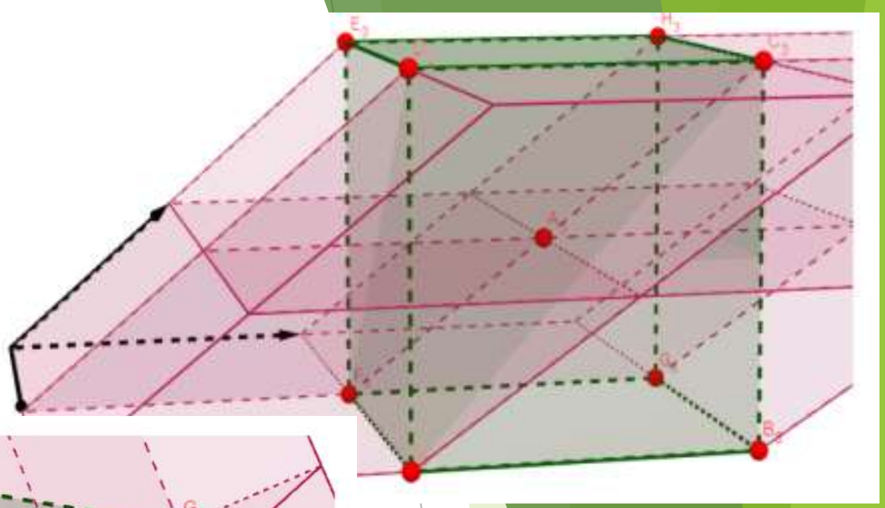
$$v = |\boldsymbol{a}||\boldsymbol{b}||\boldsymbol{c}|sin\beta$$

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

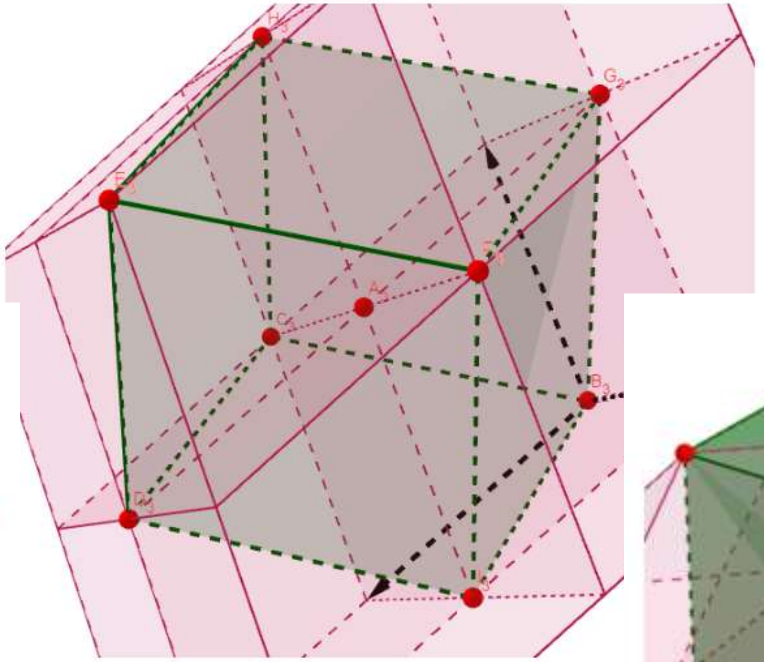
Parte I: BCC $\boldsymbol{a} = a\hat{\boldsymbol{\imath}}, \boldsymbol{b} = a\hat{\boldsymbol{\jmath}}, \boldsymbol{c} = a(\hat{\boldsymbol{\imath}} + \hat{\boldsymbol{\jmath}} + \widehat{\boldsymbol{k}})/2$





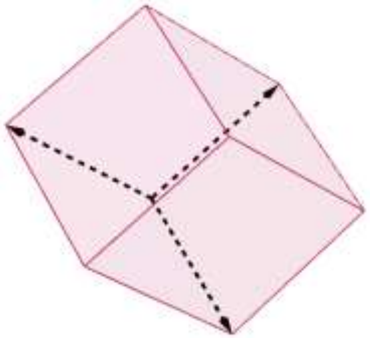
$$\mathbf{c}\cdot(\mathbf{a}\times\mathbf{b}) = \begin{vmatrix} \frac{a}{2} & \frac{a}{2} & \frac{a}{2} \\ a & 0 & 0 \\ 0 & a & 0 \end{vmatrix} = \frac{a^3}{2}$$

Parte II: BCC

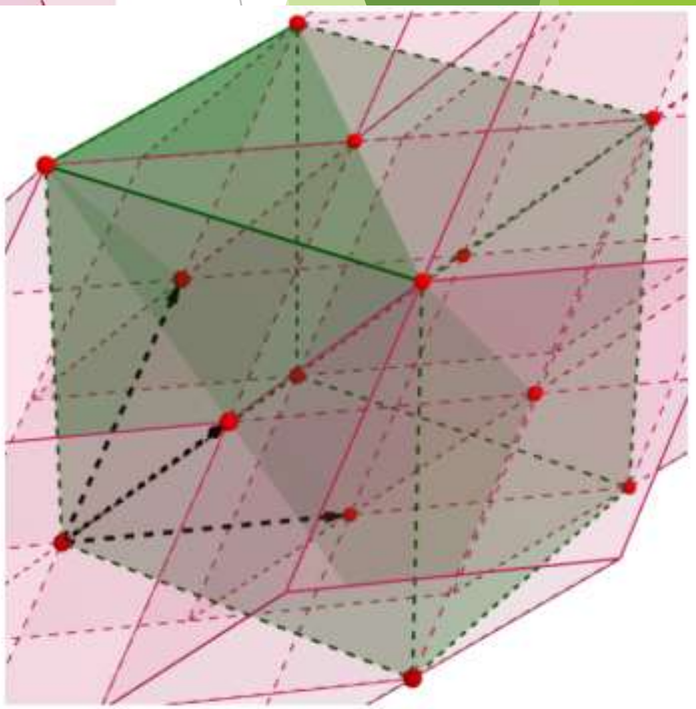


$\boldsymbol{a} = a(\hat{\boldsymbol{\jmath}} + \widehat{\boldsymbol{k}} - \hat{\boldsymbol{\imath}})/2, \boldsymbol{b} = a(\hat{\boldsymbol{\imath}} + \widehat{\boldsymbol{k}} - \hat{\boldsymbol{\jmath}})/2, \boldsymbol{c} = a(\hat{\boldsymbol{\imath}} + \hat{\boldsymbol{\jmath}} - \widehat{\boldsymbol{k}})/2$

$$\mathbf{c}\cdot(\mathbf{a}\times\mathbf{b}) = \begin{vmatrix} \frac{a}{2} & \frac{a}{2} & -\frac{a}{2} \\ -\frac{a}{2} & \frac{a}{2} & \frac{a}{2} \\ \frac{a}{2} & -\frac{a}{2} & \frac{a}{2} \end{vmatrix} = \frac{a^3}{2}$$

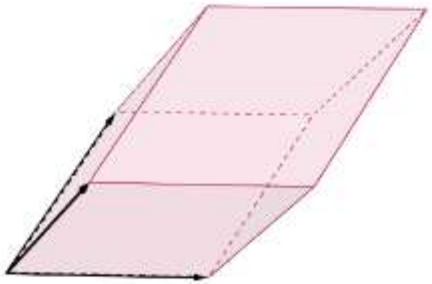


Parte III: FCC



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

$$\mathbf{c}\cdot(\mathbf{a}\times\mathbf{b}) = \begin{vmatrix} \frac{a}{2} & \frac{a}{2} & 0 \\ 0 & \frac{a}{2} & \frac{a}{2} \\ \frac{a}{2} & 0 & \frac{a}{2} \end{vmatrix} = \frac{a^3}{4}$$



Inciso d

	Vectores primitivos:	Vectores recíprocos	Volumen celda recíproca
Cúbico simple	$\boldsymbol{a} = a\hat{\imath}, \boldsymbol{b} = a\hat{\jmath}, \boldsymbol{c} = a\hat{k}$	$\mathbf{a}' = (\frac{1}{a}, 0, 0)$ $\mathbf{b}' = (0, \frac{1}{a}, 0)$ $\mathbf{c}' = (0, 0, \frac{1}{a})$	$\mathbf{c}' \cdot (\mathbf{a}' \times \mathbf{b}') = \mathrm{V} = \frac{1}{a^3}$
BCC (C-1)	$\boldsymbol{a} = a\hat{\imath}, \boldsymbol{b} = a\hat{\jmath},$ $\boldsymbol{c} = a(\hat{\imath} + \hat{\jmath} + \hat{k})/2$	$\mathbf{a}' = (\frac{1}{a}, 0, -\frac{1}{a})$ $\mathbf{b}' = (0, \frac{1}{a}, -\frac{1}{a})$ $\mathbf{c}' = (0, 0, \frac{2}{a})$	$\mathbf{c}' \cdot (\mathbf{a}' \times \mathbf{b}') = \mathrm{V} = \frac{2}{a^3}$
BCC (C-2)	$\boldsymbol{a} = \frac{a(\hat{\jmath} + \hat{k} - \hat{\imath})}{2},$ $\boldsymbol{b} = \frac{a(\hat{\imath} + \hat{k} - \hat{\jmath})}{2},$ $\boldsymbol{c} = a(\hat{\imath} + \hat{\jmath} - \hat{k})/2$	$\mathbf{a}' = (0, \frac{1}{a}, \frac{1}{a})$ $\mathbf{b}' = (\frac{1}{a}, 0, \frac{1}{a})$ $\mathbf{c}' = (\frac{1}{a}, \frac{1}{a}, 0)$	$\mathbf{c}' \cdot (\mathbf{a}' \times \mathbf{b}') = \mathrm{V} = \frac{2}{a^3}$
FCC(C-3)	$\boldsymbol{a} = \frac{a(\hat{\jmath} + \hat{k})}{2}, \boldsymbol{b} = \frac{a(\hat{\imath} + \hat{k})}{2},$ $\boldsymbol{c} = a(\hat{\imath} + \hat{\jmath})/2$	$\mathbf{a}' = (-\frac{1}{a}, \frac{1}{a}, \frac{1}{a})$ $\mathbf{b}' = (\frac{1}{a}, -\frac{1}{a}, \frac{1}{a})$ $\mathbf{c}' = (\frac{1}{a}, \frac{1}{a}, -\frac{1}{a})$	$\mathbf{c}' \cdot (\mathbf{a}' \times \mathbf{b}') = \mathrm{V} = \frac{4}{a^3}$