Vector simulation
보충자료

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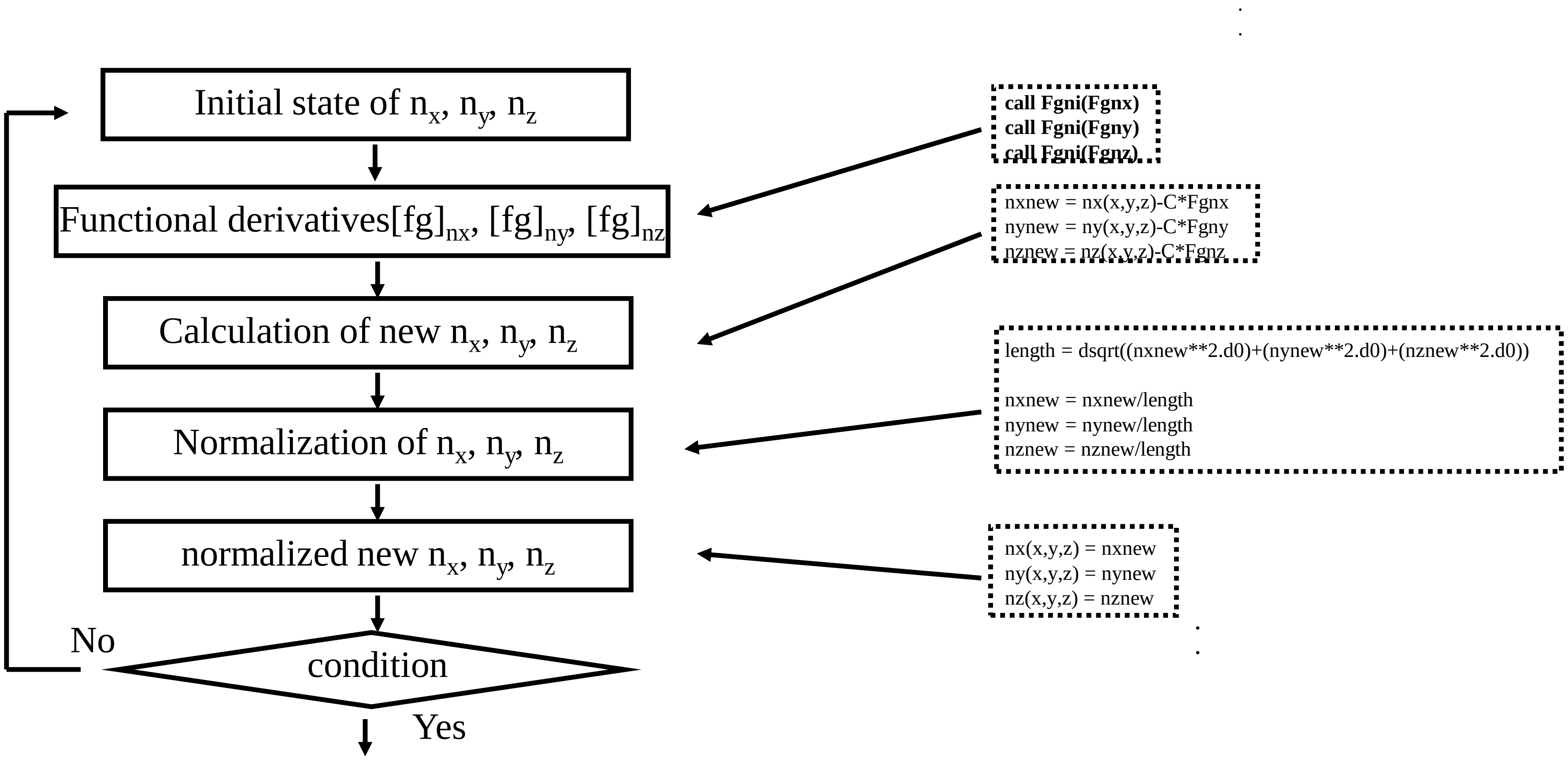
Vector Method

- Flow chart for calculation (Vector method)(LC3D by James Anderson)



Vector Method

- *Euler-Lagrange* equations for vector method

$$0 = -[f_g]_{n_i}$$

$$0 = -[f_g]_V = \nabla \cdot D = \nabla \cdot (\varepsilon_0 \varepsilon_r \nabla V)$$

$[f_g]_{n_i}$: *Functional Delivatives by* n_i

$[f_g]_V$: *Functional Delivatives by voltage V*

$$[f_g]_{n_i} = \frac{\partial f_g}{\partial n_i} - \frac{d}{dx}\left(\frac{\partial f_g}{\partial n_{i,x}}\right) - \frac{d}{dx}\left(\frac{\partial f_g}{\partial n_{i,y}}\right) - \frac{d}{dx}\left(\frac{\partial f_g}{\partial n_{i,z}}\right)$$

$$n_{i,x} = \frac{\partial n_i}{\partial x}, \quad n_{i,y} = \frac{\partial n_i}{\partial y}, \quad n_{i,z} = \frac{\partial n_i}{\partial z}$$

Vector Method

- Oseen-Frank Equation's Vector form

- In general, deformation of LC directors (Elastic term) can be achieved from *Oseen-Frank* equation (*Vector form*)

$$fs = \frac{1}{2} K_{11} (\nabla \cdot n)^2 + \frac{1}{2} K_{22} (n \cdot \nabla \times n)^2 + \frac{1}{2} K_{33} (n \times \nabla \times n)^2$$

Vector Method

$$\color{red}{splay} = \frac{1}{2}K11\left(\left(\frac{\partial}{\partial x}nx(x,y,z)\right)+\left(\frac{\partial}{\partial y}ny(x,y,z)\right)+\left(\frac{\partial}{\partial z}nz(x,y,z)\right)\right)^2$$

K11 = 0.0000000000132
K22 = 0.0000000000065
K33 = 0.0000000000183
Q0 = 0

$$twist = \frac{1}{2}K22\left((nx(x,y,z))\left(\left(\frac{\partial}{\partial y}nz(x,y,z)\right)-\left(\frac{\partial}{\partial z}ny(x,y,z)\right)\right)+(ny(x,y,z))\left(\left(\frac{\partial}{\partial z}nx(x,y,z)\right)-\left(\frac{\partial}{\partial x}nz(x,y,z)\right)\right)\right.$$
$$\left.+(nz(x,y,z))\left(\left(\frac{\partial}{\partial x}ny(x,y,z)\right)-\left(\frac{\partial}{\partial y}nx(x,y,z)\right)\right)+q0\right)^2$$

$$bend = \frac{1}{2}K33\left(\left(ny(x,y,z)\left(\frac{\partial}{\partial x}ny(x,y,z)\right)-ny(x,y,z)\left(\frac{\partial}{\partial y}nx(x,y,z)\right)-nz(x,y,z)\left(\frac{\partial}{\partial z}nx(x,y,z)\right)+nz(x,y,z)\left(\frac{\partial}{\partial x}nz(x,y,z)\right)\right)^2\right.$$
$$+\left(nz(x,y,z)\left(\frac{\partial}{\partial y}nz(x,y,z)\right)-nz(x,y,z)\left(\frac{\partial}{\partial z}ny(x,y,z)\right)-nx(x,y,z)\left(\frac{\partial}{\partial x}ny(x,y,z)\right)+nx(x,y,z)\left(\frac{\partial}{\partial y}nx(x,y,z)\right)\right)^2$$
$$\left.+\left(nx(x,y,z)\left(\frac{\partial}{\partial z}nx(x,y,z)\right)-nx(x,y,z)\left(\frac{\partial}{\partial x}nz(x,y,z)\right)-ny(x,y,z)\left(\frac{\partial}{\partial y}nz(x,y,z)\right)+ny(x,y,z)\left(\frac{\partial}{\partial z}ny(x,y,z)\right)\right)^2\right)$$

Vector Method

Surface Top tilt : 0
Surface Bottom tilt : 0
Bulk : 90