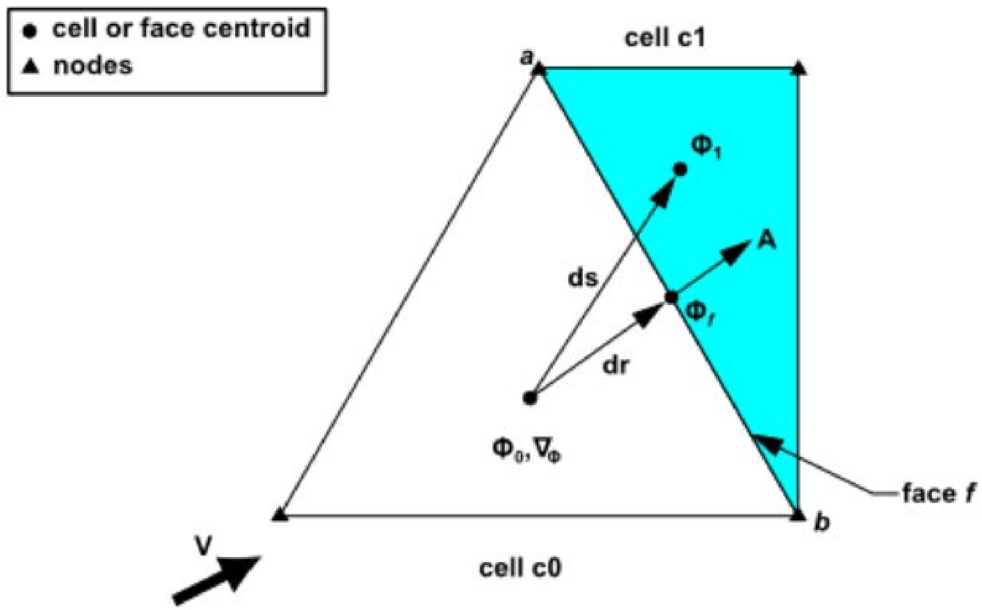
Critérios para Avaliação da Ortogonalidade da Malha

Correção de não-ortogonalidade

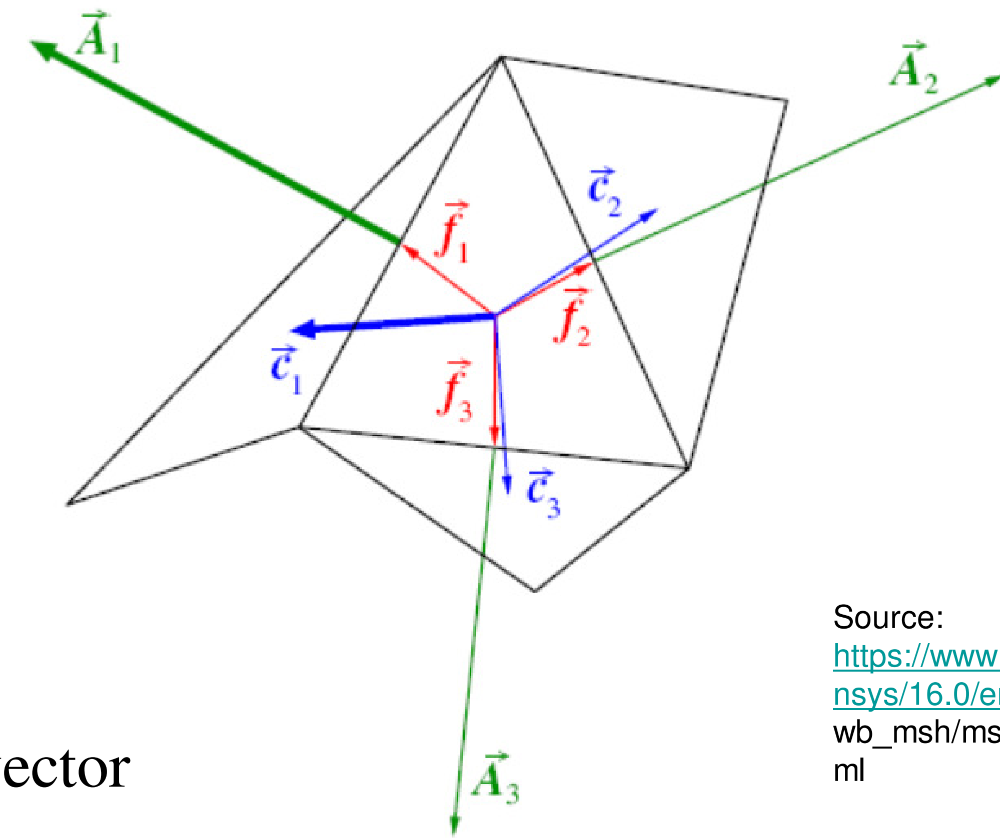
$$\vec{A} = A\vec{n} \qquad \vec{e}_s : \textit{versor na direção de } ds$$

$$\underbrace{\Gamma \nabla \phi . \vec{A}}_{\text{tem que ser avaliada ao fim de uma iteração}} = \underbrace{\Gamma \frac{(\phi_1 - \phi_0)}{ds} \frac{\vec{A}.\vec{A}}{\vec{A}.\vec{e}_s}}_{\text{vai ser usada para formar o coeficiente de difusão do sistema linear}} + \underbrace{\Gamma \left(\nabla \phi . \vec{A} - \nabla \phi . \vec{e}_s \frac{\vec{A}.\vec{A}}{\vec{A}.\vec{e}_s} \right)}_{\text{parcela avaliada antes de fazer uma iteração}}$$



Extraído de ANSYS Fluent UDF manual, Release 14.

$$\Gamma \nabla \phi . \vec{A} = \underbrace{\Gamma \frac{1}{ds} \frac{\vec{A}.\vec{A}}{\vec{A}.\vec{e}_s}}_{\text{forma o coeficiente de difusão do sistema linear}} (\phi_1 - \phi_0) + \underbrace{\Gamma \left(\nabla \phi . \vec{A} - \nabla \phi . \vec{e}_s \frac{\vec{A}.\vec{A}}{\vec{A}.\vec{e}_s} \right)}_{\text{correção devida à não–ortogonalidade da malha que é deferida ao carregamento do sistema linear}}$$

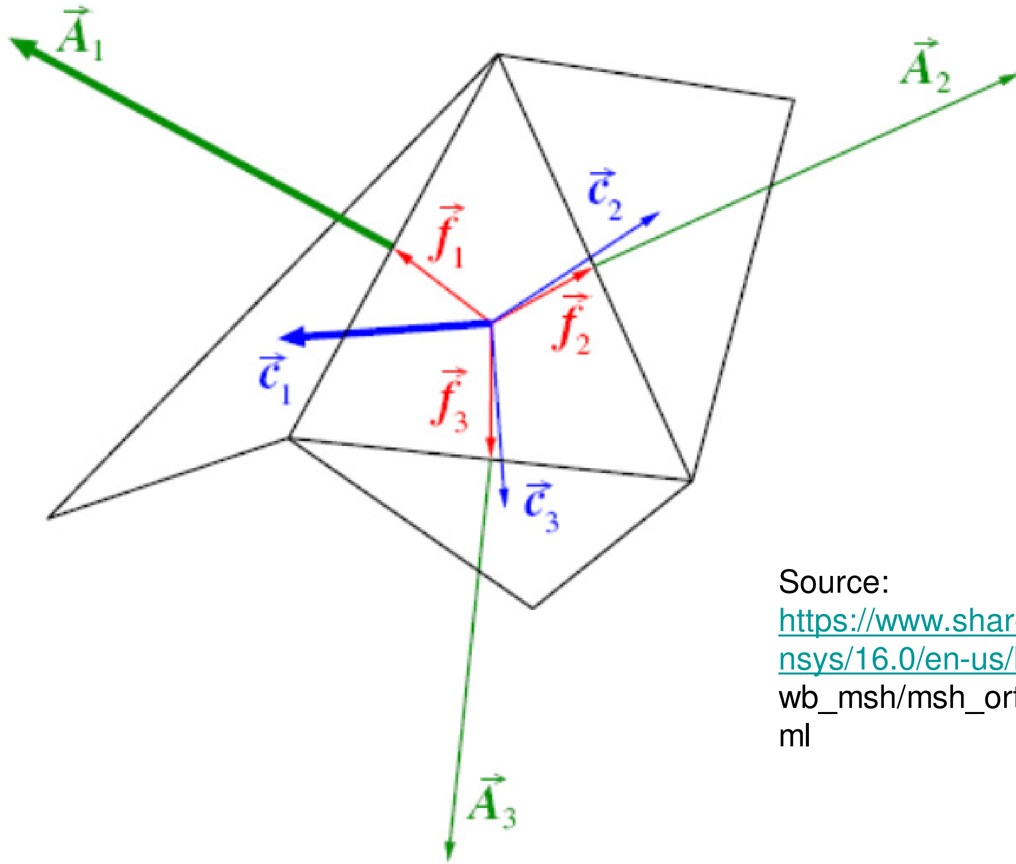


Source:
https://www.sharcnet.ca/Software/Ansys/16.0/en-us/help/
wb_msh/msh_orthogonal_quality.html

$\vec{A}_i$: face normal vector

$\vec{f}_i$: vector from the centroid of the cell to the centroid of the face

$\vec{c}_i$: vector from the centroid of the cell to the centroid of the adjacent cell that shares the face

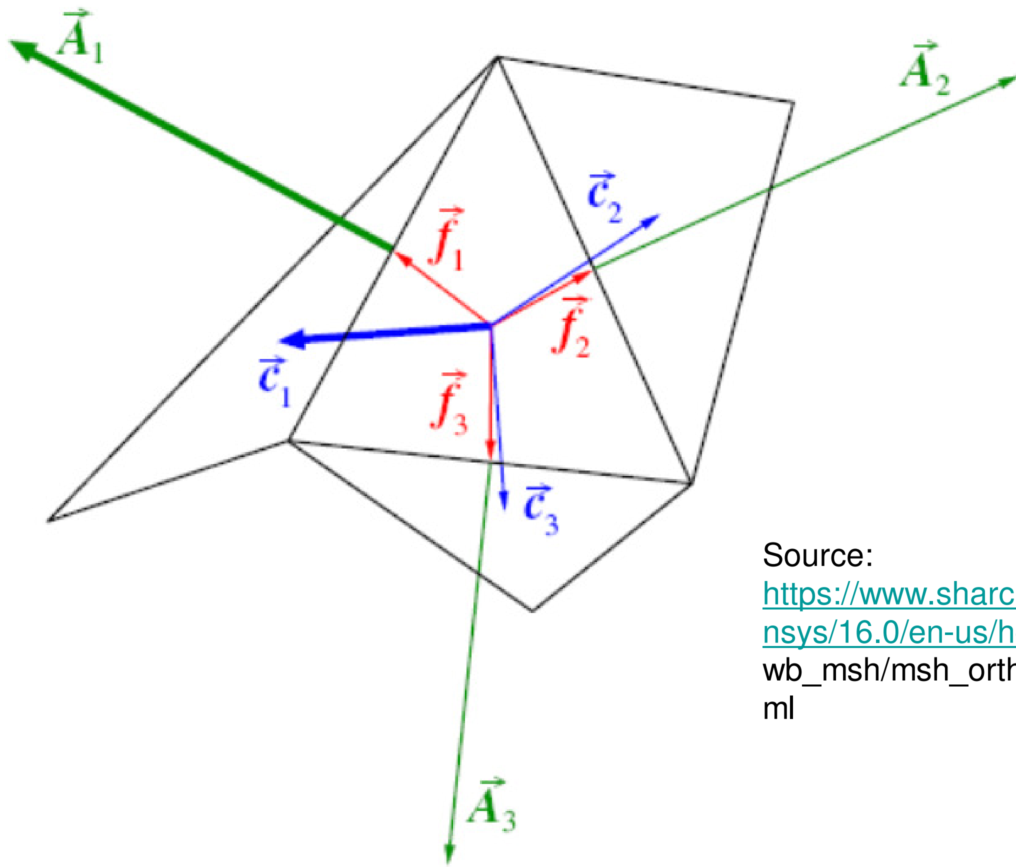


Source:
https://www.sharcnet.ca/Software/Ansys/16.0/en-us/help/wb_msh/msh_orthogonal_quality.html

ANSYS© FLUENT™ :

$$\text{orthogonal quality} = \min\left(\frac{\vec{A}_i \cdot \vec{f}_i}{|\vec{A}_i||\vec{f}_i|}, \frac{\vec{A}_i \cdot \vec{c}_i}{|\vec{A}_i||\vec{c}_i|} \right)$$

Best when close to 1.

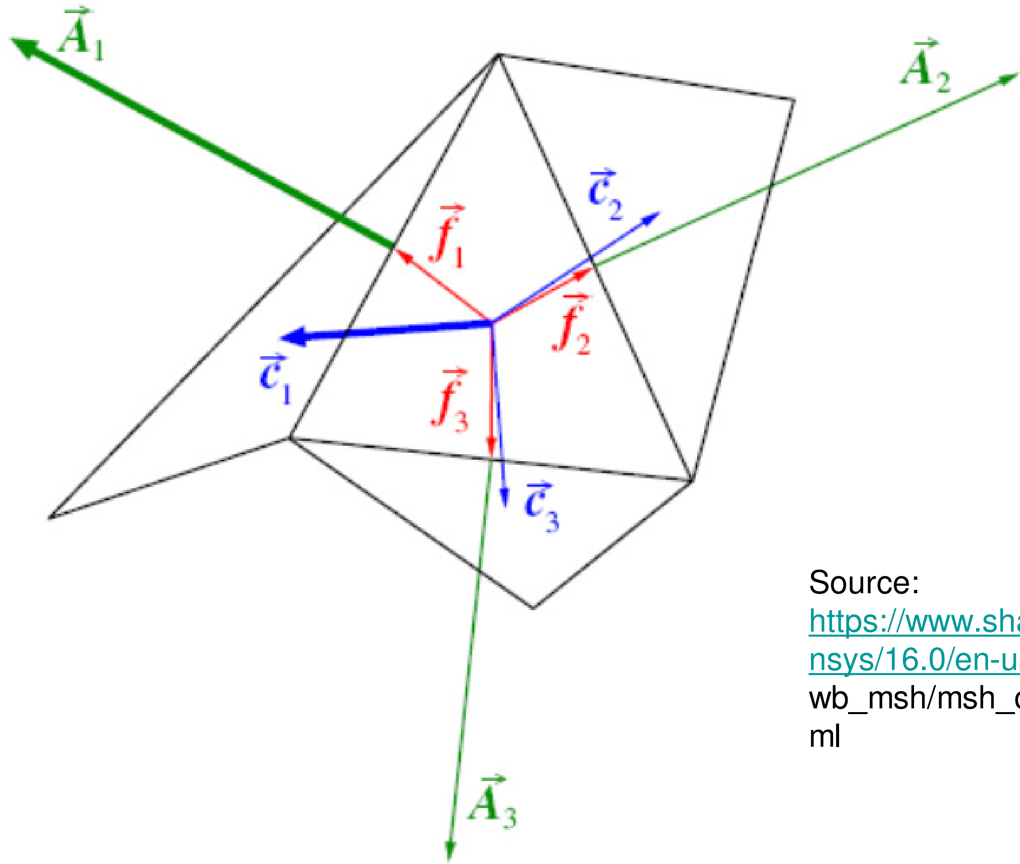


Source:
https://www.sharcnet.ca/Software/Ansys/16.0/en-us/help/wb_msh/msh_orthogonal_quality.html

ANSYS© CFX™

$$\text{minimum orthogonality angle} = \min\left(90^\circ - \operatorname{acos}\left(\frac{\vec{A}_i \cdot \vec{c}_i}{\left|\vec{A}_i\right|\left|\vec{c}_i\right|}\right)\right)$$

Best when close to 90º.



Source:
https://www.sharcnet.ca/Software/Ansys/16.0/en-us/help/wb_msh/msh_orthogonal_quality.html

OpenFOAM©

$$\text{maximum orthogonality angle} = \max\left(\operatorname{acos}\left(\frac{\vec{A}_i \cdot \vec{c}_i}{|\vec{A}_i||\vec{c}_i|} \right) \right)$$

Best when close to 0º.