VORONOI APPLIED ELEMENT METHOD

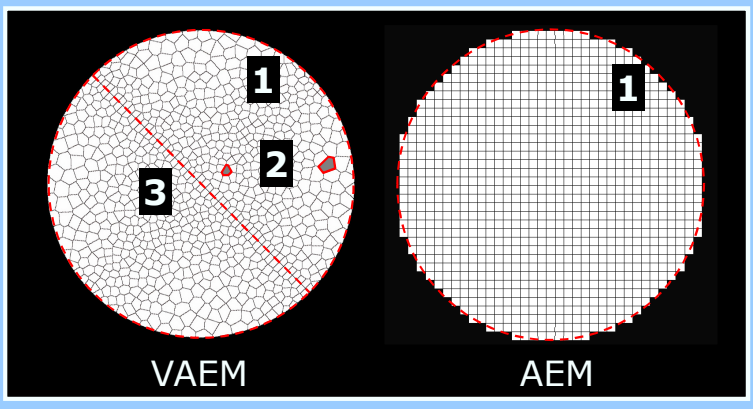
ボロノイ分割応用要素法解析

Voronoi Applied Element Method (VAEM) :

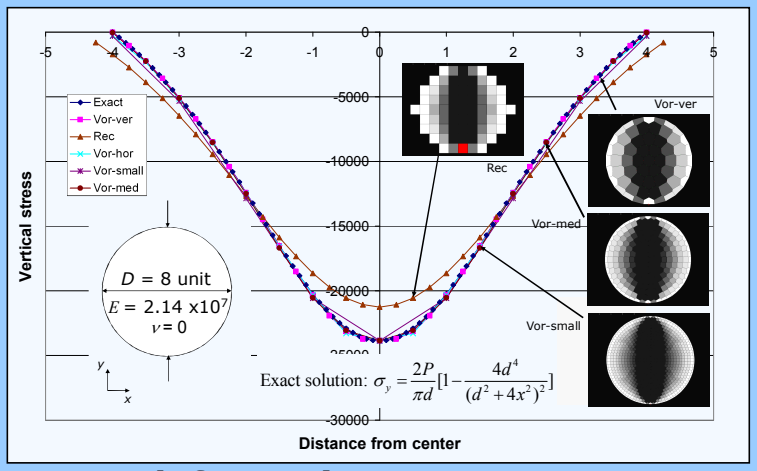
the new version of applied element method containing Voronoi shape element.

Benefits:

1) Easier fit non-rectangular boundary
2) Element size variation
3) Pre-existing weak plane
4) Implicit Poisson's ratio



Elastic:



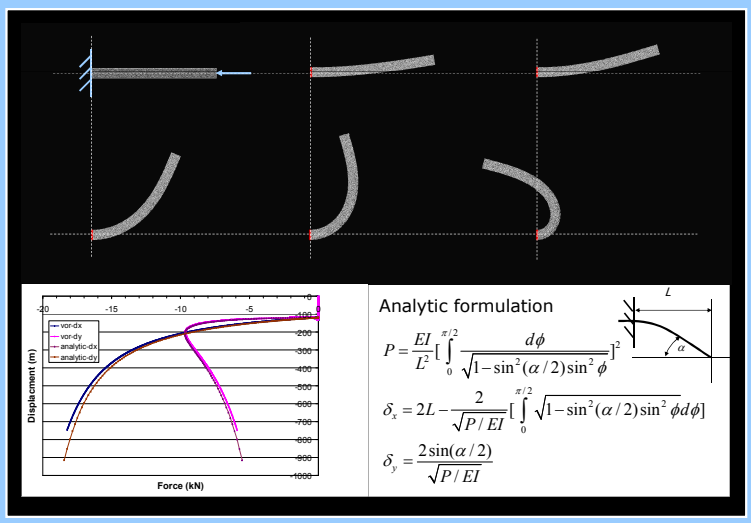
Large deformation: Additional procedure

1) Update the location of the element node
2) Calculate the geometrical residuals as

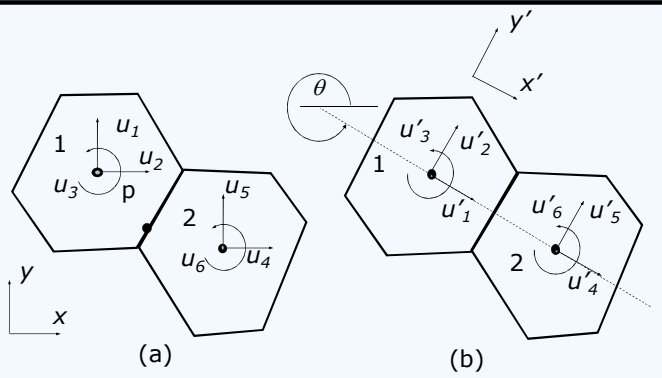
{RG}={f}-{Fm}

4) Take into account the geometrical residual

[K]{u} = {r}+{R_G}

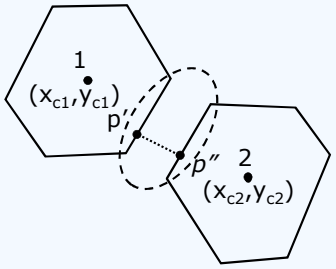


Stiffness Matrix:

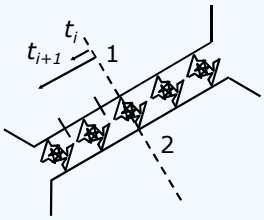


Two-particle assemblage and their degrees of freedom

(a) global coordinate (b) local coordinate



Two-particle assemblage after deformed



Normal and shear springs at element boundary

By writing the springs strain energy and apply Castigiano theorem, we obtains:

Stiffness matrix $[K]=\int [B]^T[D][B]dS$

where $[B]=\begin{bmatrix} -1 & 0 & (y-y_{c1}) & 1 & 0 & -(y-y_{c2}) \\ 0 & -1 & -(x-x_{c1}) & 0 & 1 & (x-x_{c2}) \end{bmatrix}$

and $[D]=\begin{bmatrix} k_n & 0 \\ 0 & k_n \end{bmatrix}$

Fracture: