Subgroup LTAS-Fracture Mechanics

- **Keywords**
  - MODELISATION, FINITE ELEMENT BOUNDARY ELEMENT
  - FRACTURE, DAMAGE, FATIGUE
  - PLASTICITY, VISCOPLASTICITY
  - LIMIT ANALYSIS AND LIMIT DESIGN
  - COMPOSITES, CERAMICS
- **Staff**
  - Four engineer-researchers, two PhD students
  - One technician, one and a haft secretary
- **Research interests**
  - Modelisation of cracks structures and estimation of toughness and duration of life.
  - Simulation of propagation of the cracks under fatigue conditions.
  - Delamination of composite and ceramic structures.
  - Direct computational of the limit states (limit analysis, shakedown analysis) using mathematical programming techniques.

Subgroup LTAS-Fracture Mechanics

- **Typical current research contracts (Failures by plastic deformations)**
  - *Development and improvement of the CEPAO software for the analysis and the optimal plastic design of frame structures in the conditions of simple and cyclic loading,* **Continuous research.**
  - *Limit and shakedown analysis of elbows pipes and nuclear components by finite element methods and mathematical programming techniques.* **Research in collaboration with NNC, subsidized by CEE-AG2.**
  - *Comparative studies of the direct determination of the limit states (limit analysis, limit shakedown) by mathematical programming the techniques with the step by step elastoplastique algorithm.* **Research in collaboration with NNC, FPMS, subsidized by CEE-AG2.**

Subgroup LTAS-Fracture Mechanics

Typical current research contracts (Failures by fractures)

- *Comparative studies of the classic methods, V.C.E , E.D.I. and integral J for the computation of the stress of intensity factors of 3D cracked structures in linear and nonlinear conditions.* **Research ordered by Aéospatiale-Toulouse, Eurocopter-Marignane and SEP via SAMTECH.**
- *Determination of the toughness of the cracked structures (Multicrack problem, crack growth under fatigue by Boundary Element Method.* **Continuous Research.**
- *Automatic meshing into finite elements and automatic numertical sticking of a cracked box.* **Research ordered by Eusocopter-Marignane via SAMTECH.**
- *Modelisation of the delamination of the composites.* **Research subsidized by the Mobilization Program on the Multimaterials, Walloon Region.**

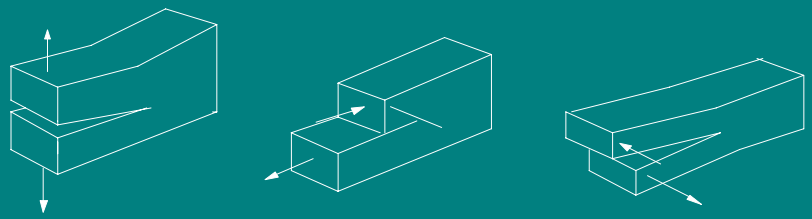
Subgroup LTAS-Fracture Mechanics

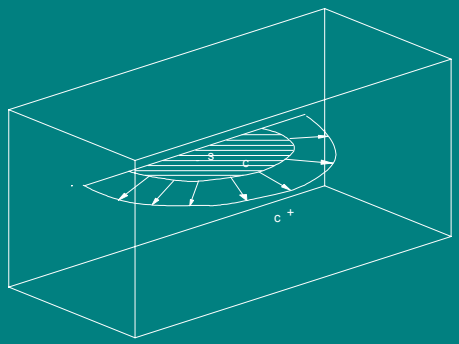
Typical PhD thesis

- *On some problems in solid mehanics with convex potentials*, (G. de SAXCE, 1986).
- *Limit analysis with second order effects*, (B. BORHANI, Compiègne - 1988).
- *On the dual shakedown analysis of plates and shells using finite element method and mathematical programming techniques*, (P. MORELLE, 1989).
- *A singular family of hybrid finite elements useful for cracked metallic and composite structures*, (C.H. KANG, Compiègne 1991, co-directed with G. de SAXCE).
- *Limit states of elbows using finite element method and mathematical prgramming techniques*, (R.J. JOSPIN, 1992).
- *Comparison of direct and step by step elastoplastic analysis of structures sujected to repeated loading*, (C.T. BUI, in preparation).
- *Multiple cracks growth under fatigue by Dual Boundary Element Method*, (A.M. JAN, in preparation)...

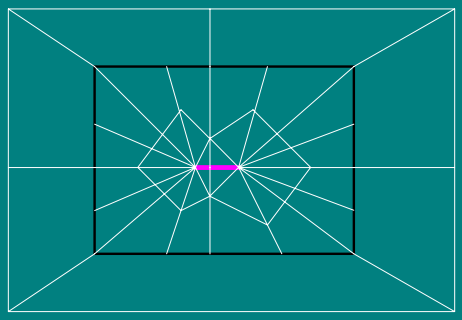
Effects of residual stresses in cracked structures (metallic) under fatigue - B1

- **Existing tools in SAMCEF for fracture mechanics**





Box of crack



Numerical sticking

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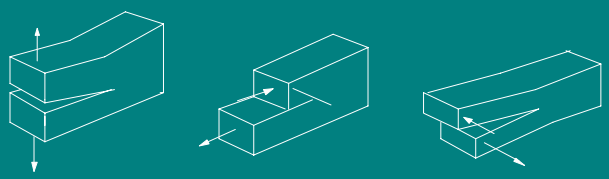
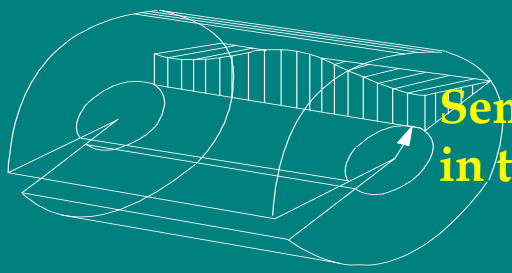
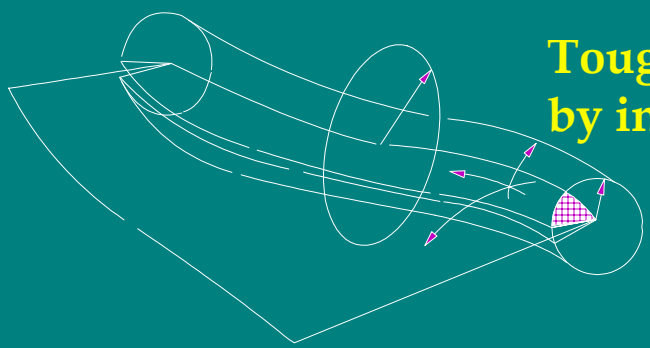
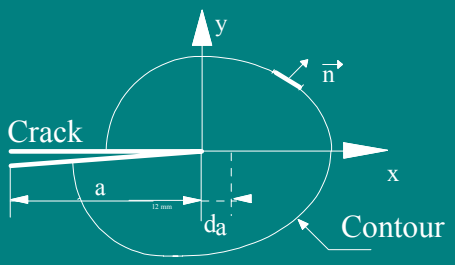




Semi-automatic meshing in the neighbourhood of crack



Toughness estimation by integral J via EDI method



Effects of residual stresses in cracked structures (metallic) under fatigue - B1

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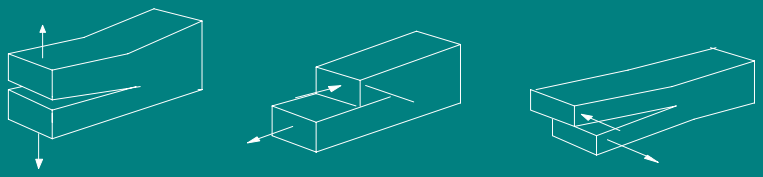
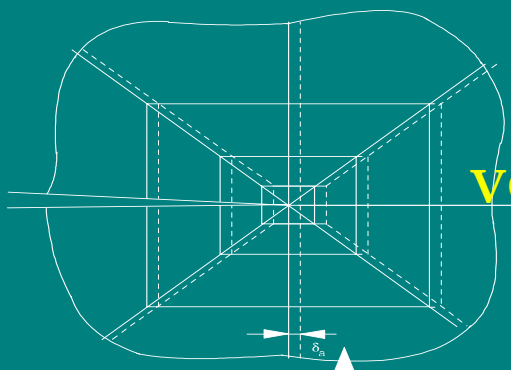
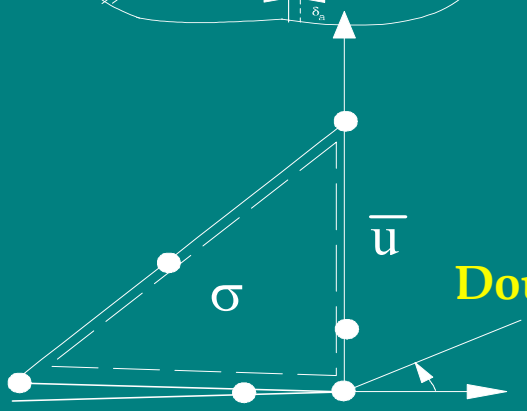




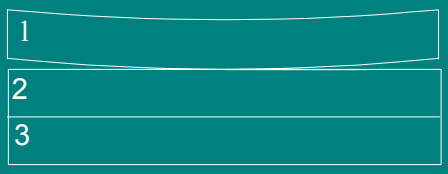
VCE estimation of toughness

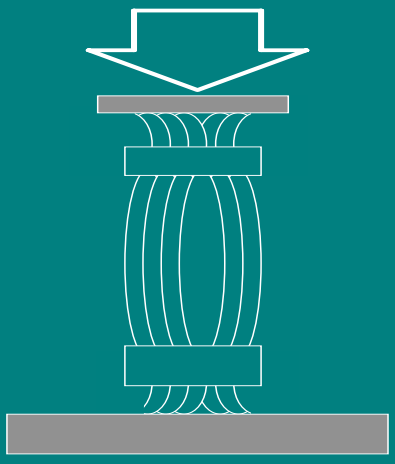


Doubly Singular Metis Element

Modelisation and simulation of growth of damage and failure of composite structures under fatigue loadings - B3

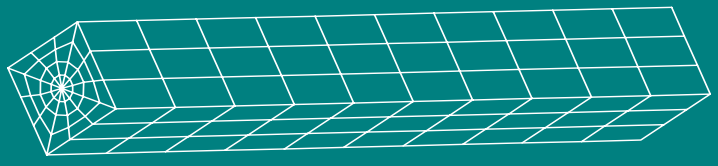
- **Research subsidized by the Mobilization Program on the Multimaterials, Walloon Region.**

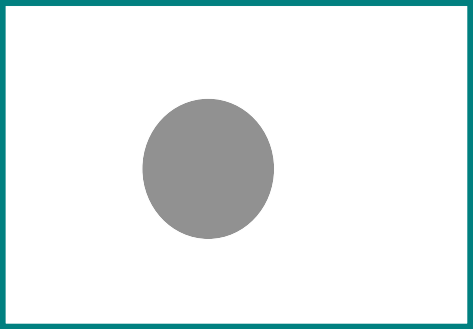




Delamination
Damage
Fatigue ?
Impact ?

Homogenization





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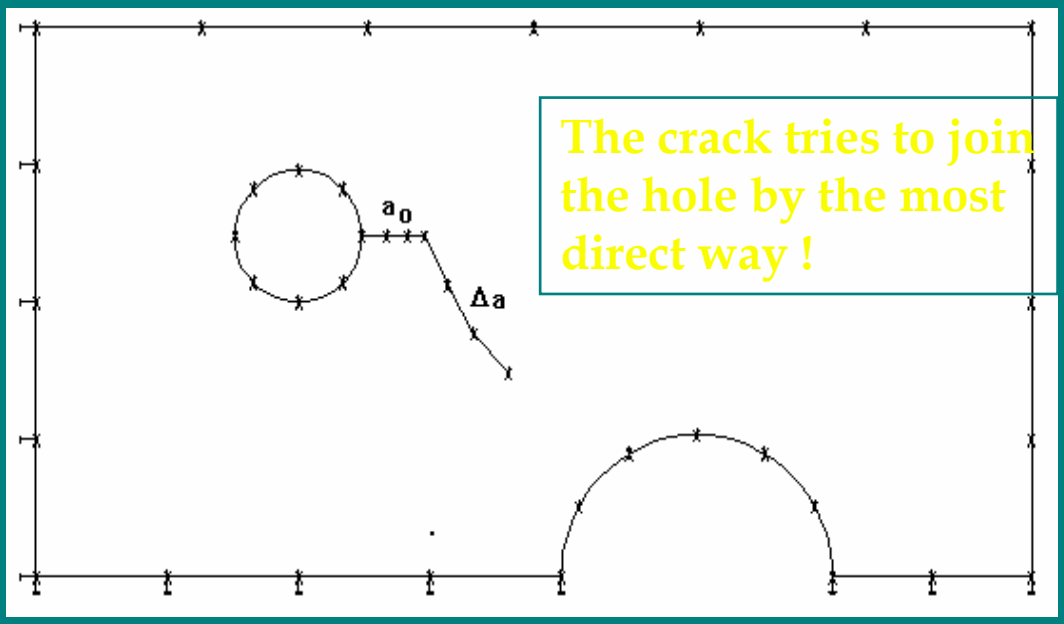
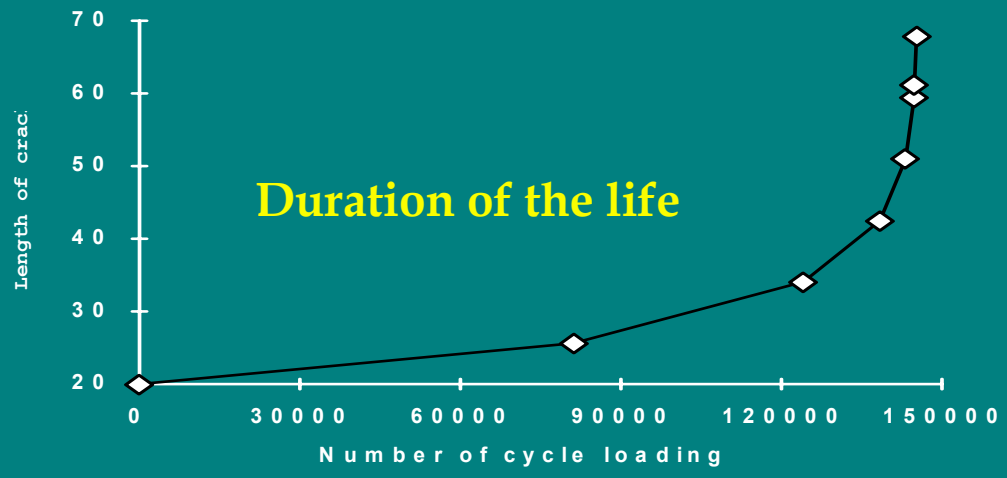
- **Modelisation of crack growth using Dual Boundary Element Method**





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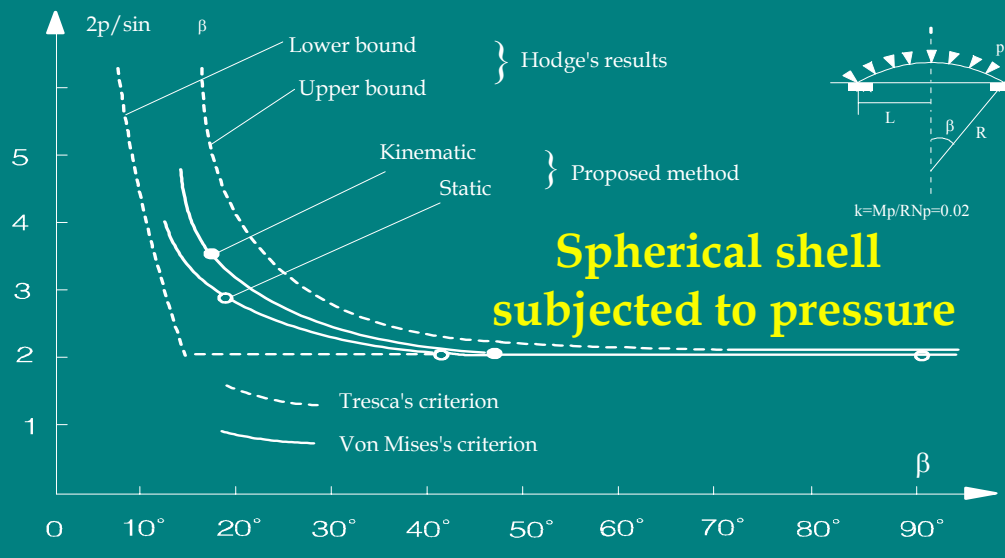
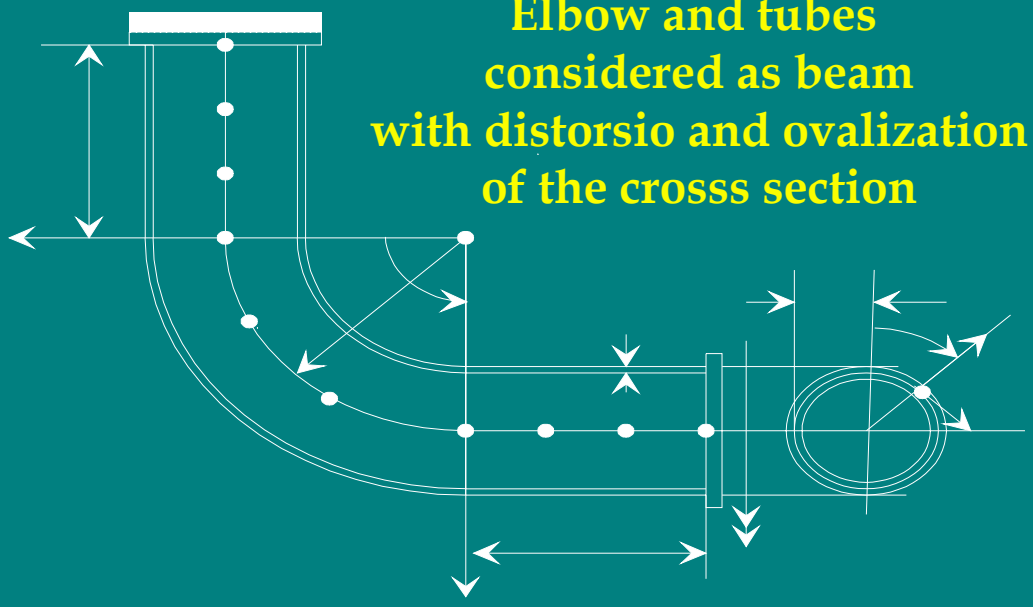
- **Limit analysis and shakedown analysis of plates, pipes and shells**



Spherical shell subjected to pressure



Elbow and tubes considered as beam with distorsio and ovalization of the crosss section

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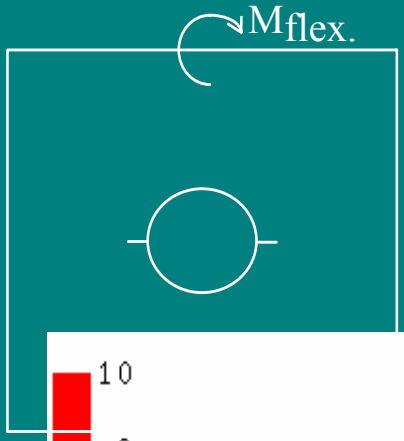
- **Existing tools in SAMCEF for fracture mechanics**



Toughness computation of 3 D structures Von-Mises stresses distribution