Overview of SALOME

code_aster, salome_meca course material  
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Outline of the presentation

- What can we do with SALOME?
  - Geometries → The GEOMETRY module
  - Meshes → The MESH module
  - Visualization → The PARAVIS module
What can we do with SALOMÉ?

1. Import and export, repair and clean, create and modify geometries (CAD)

- Mesh, quality control, import / export meshes
- Manipulate the physical and numerical properties of a geometry

2. Manage the various stages of a computation: receive data, setting up a calculation, return results

- Run computation sequences and coupling between solvers

3. View and post-process the results
GEOMETRY module

- Design of geometric objects
- Import / Export of objects of different CAD formats
- Repair and correction of CAD models
- Adaptation of CAD models for computer simulation
- Based on the Open Cascade technology
GEOMETRY module: Import & Viewers

- Various import / export formats
  - STEP
  - IGES (5.1 & 5.3)
  - BREPS
  - STL (Export)
  - ACIS (CATIA V5, commercial)

- Graphic functionalities
  - Transparency
  - Coloring
  - Shading/Wireframe
  - Rotation, zoom, pan ...
GEOMETRY module: GUI

Salome components
Basic primitives
3D primitives
Advanced primitives
Boolean operations
Generations
Transformations
Operations
Constructions
Measures
GEOMETRY module: Terminology

<table>
<thead>
<tr>
<th>vertex</th>
<th></th>
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<tbody>
<tr>
<td>edge</td>
<td></td>
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<tr>
<td>wire (set of edges)</td>
<td></td>
</tr>
<tr>
<td>face (constructed from a closed wire)</td>
<td></td>
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<tr>
<td>shell (set of faces)</td>
<td></td>
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<tr>
<td>solid (constructed with a closed shell)</td>
<td></td>
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<tr>
<td>compound (set of any types)</td>
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Open Cascade and Step standard terminology
GEOMETRY module: conception

Geometric primitives
- 1D: line, circle, ellipse, arc, curve, vector
- 2D: plan, working plan
- 3D: parallelepiped, cylinder, sphere, torus, cone
- Sketch 2D/3D: construction of complex lines or surfaces
- Construction of elementary objects: vertex, edge, wire, face, shell, solid, compound
- Advanced primitives: Tee pipe

Operations
- Boolean: merge, join, cut, intersect
- Fillet, chamfer, partition
- Explode: decomposition into basis objects

Transformations
- translate, rotate, mirror, scale, offset
- multi-translation, multi-rotation

Generations
- Extrusion, revolution, filling, pipes

Information
- « What is it?”, mass centre, inertia, tolerance, bounding box, min. distance, coordinates, angle
GEOMETRY module: partitions and objects

Define at this step the relevant topological entities to ease mesh creation, calculation setup, and result post-processing.

Geometric groups
- Manage geometric objects from which can be created element / node groups required when assigning boundary conditions or material properties...

Geometric operations to define partitions in a mesh
- Non-manifold geometry
- For hexahedral meshing:
  - Split non-hexahedral shape into hexahedral ones
  - To define different refinements
  - To merge
  - …
MESH module

- The geometric model is imported from GEOM module
- Information and quality control of meshes
- Groups of nodes or elements and operations on these groups
- Various import / export formats: MED, UNV, STL, CGNS
- Modifications of meshes

Principles:
- One algorithm for each dimension (example in 1D: Wire discretization)
- One hypothesis for each algorithm (example: Nb. Segments)

The mesh calculation starts from the smallest to the largest dimension:

0D → 1D → 2D → 3D
MESH module: algorithms

For each dimension, several algorithms are available:

- **1D**
  - Wire discretization
  - Projection 1D
  - ...

- **2D**
  - Quadrangle (Mapping)
  - Netgen 1D-2D
  - BLSurf
  - ...

- **3D**
  - Tetrahedrons (NETGEN)
  - Tetrahedrons(GHS3D)
  - Hexahedrons (i,j,k)
  - ...

Some algorithms are multidimensional:

- **1D-2D**
  - BLSurf
  - Netgen 1D-2D

- **1D-2D-3D**
  - Netgen 1D-2D-3D
The parameters of a meshing algorithm are set through a hypothesis.

Example for a 1D mesh

- **Algo 1D**:
  - *Wire discretization*
- Associated hypothesis:
  - *Nb. Segments = 4*
  - *Equidistant distribution*
The parameters of a meshing algorithm are set through a hypothesis.

Example for a 2D mesh

- **Algo 1D**: 
  - *Wire discretization*
  - Associated hypothesis:
    - *Nb. Segments = 4*
    - Equidistant distribution

- **Algo 2D**: 
  - *Quadrangle (Mapping)*
PARAVIS module: terminology

The SALOME post-processing module based on ParaView
- With functionalities added by EDF
  - MED interface
  - Integration points
  - Modal animation

Filters
- In Paravis, the data is managed by means of filters.
  - Example: Deformed shape, cutting plane …
- The filters depend on the type of data. They can be chained.
  - Initial data ➔ Filter 1 ➔ Filter 2 ➔ …

Views
- A surface on which you can see the data.
  - Example: 3D, 2D, histogram, plot…

Displays
- The data can be seen in different ways in different views
  - Example: Surface, Wireframe, PointSprite…
PARAVIS module: a rich and powerful tool

Visualization of a displacement field
PARAVIS module: a rich and powerful tool

 Visualization of a field at Gauss points (integration points)
PARAVIS module: a rich and powerful tool

- Creation and animation of cutting plane
PARAVIS module: a rich and powerful tool

- **Modal analysis**: deformed and animation of multiple modes
PARAVIS module: a rich and powerful tool

- Data extracts (cuts) and quantitative analyzes
SALOME: where to find information?

Online help

The Paraview Tutorial ➔

http://www.paraview.org/Wiki/The_ParaView_Tutorial
End of presentation

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Or feeling happy to have read such a clear tutorial?

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