The problem to solve

- From a detailed CAD definition of a spacecraft
  - Engineering, architectural, mechanical...
- ...to a generated simplified geometry
  - Equivalent for thermal analysis purpose
  - But with only a few thousand polygons

CATIA / AP203/214

Converter

STEP-TAS / Thermal Soft.

> 60 000 polygons

< 10 000 polygons
Project history: Prototype

- 2004: AP203/214 to STEP-TAS converter:
  - Hanop prototype
  - C++
  - Triangulation & OpenCascade 5.2
  - STEP-TAS & PyExpress

- Improvements:
  - AP203/214 parsing: CATIA V4 & V5, Pro*Engineer...
  - OpenSource technologies
  - Open to several thermal tools thanks to TASverter
Current project: Goals

- Start from the prototype

- Shape recognition:
  - Reduce the number of triangles
  - Transform into STEP-TAS primitive shapes (cone, cylinder, disc, paraboloid, quadrilateral, …)

- Model simplification:
  - Eliminate the non-relevant holes or fillets
  - Improve the transformation into STEP-TAS primitive shapes

- -> Industrial product
Main goal:
- Reduce the number of facets

Approach:
- Simplify the model

Input:
- AP203/214 Files
- Read the file
- Simplification ex: remove Holes, fillets
- Analyse the faces

If primitive shape recognized
- Primitive TAS shape

else
- Triangulation of the face with BRepMesh
- Create TAS Triangles

Output:
- STEP-TAS Files
Recognition of TAS primitive shapes (1)

- **Definition of the thermal faces:**

- **Approach:**
  - For each face, find the surface's type:
    - (Planar, cylindrical, spherical, conical surface)
  - Analyse the edge loops if necessary
  - Find the corresponding TAS primitive shape if there is one

- **Integration with Baghera View**

- **Demonstration...**

<table>
<thead>
<tr>
<th>TAS_primitive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tas_triangle</td>
</tr>
<tr>
<td>Tas_rectangle</td>
</tr>
<tr>
<td>Tas_quadrilateral</td>
</tr>
<tr>
<td>Tas_disc</td>
</tr>
<tr>
<td>Tas_cylinder</td>
</tr>
<tr>
<td>Tas_cone</td>
</tr>
<tr>
<td>Tas_sphere</td>
</tr>
<tr>
<td>Tas_paraboloid</td>
</tr>
</tbody>
</table>
The holes:
Remove holes which are irrelevant for thermal analysis

In the application:
The user can specify:
- If we remove or not the holes
- If we remove or not the cylinders of the holes
- The characteristic length threshold of the holes to remove (ex: diameter for a circular hole).
Remove Holes

Without removing holes:
8646 elements

After removing small holes:
1046 elements
**The fillets**

Often defined by a piece of cylinder.

**Algorithm:**

1. Detect the cylinder and the adjacent faces
   2. If it's a fillet:
      - find the new points of intersection.
      - modify the model (remove the cylinder and join the faces composing the fillet).

**Optional in the application.**
Detect a fillet

(example in 2D):

- Condition of detection:
  - Adjacent curves are lines
  - Adjacent lines tangent to the piece of circle (in A and B)
  - No cusp in A and B
Without removing fillets:
449 elements

After removing fillets:
263 elements
Filtering conversion with Baghera

- Only visible objects are converted
Current project: Configuration

- OS: Windows 2000 / XP, Sun Solaris 2.8, Linux RedHat Entreprise 2.1
- Compilers: Visual C++ 6.0 & 7.0, Sun Forte 6, gcc 3.4.1
- OpenCascade 5.2
- STEP-TAS V5.2
Thank you for your attention

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