

## TopSolid Project

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# Plan

- 1 Introduction
  - Missler software
  - Progressive die tool
  - Basic operations
- 2 Project content
- 3 Tasks and progress
- 4 Conclusion



Figure : TopSolid Galaxy

- First CAD/CAM solution on PC's in the 80's.  
200 people, international resellers and around 25M of turnover.
- TopSolid products :
  - General CAD/CAM : Modeling, assembly, kinematic, drafting.  
Turning, milling.
  - Tooling CAD/CAM : Mold design, progressive, transfer and stamping die design. EDM.
  - Sheet metal CAD/CAM : Sheet metal design, flat pattern computation. Punching and cutting.

## Progressive die tool

- Punch die.
- Blank holder.
- Metal strip.
- Die holder.

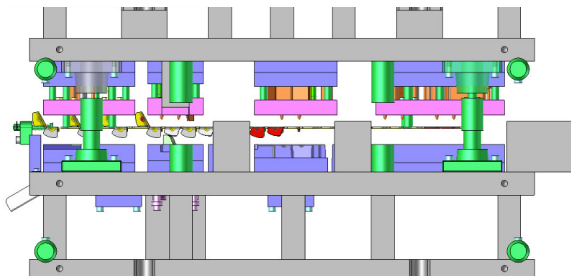


Figure : Progressive die tool

- Cutting :  
Takes some parts of the initial material off.
- Bending :  
Creation of a formed feature by angular displacement of a sheet metal workpiece.
- Stamping :  
Change the shape of the initial material by pushing it strongly.

# Plan

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- 2 Project content
  - Goal of the project
  - Specifications
  - Modelisation
  - User interface
  - Implementation model
- 3 Tasks and progress
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# Bending simulation module

For specific productions in connector industry, the bending process needs to be simulated accurately in order to :

- Compute non intuitive trajectories of the free parts of the metal sheet during multiple bending process.
- Evaluate the spring back movement.



- Bending simulation add-in.
- 2D representation.
- Sheet metal part geometry : constant thickness.
- Various punch die and punch holder shapes.
- Various material characteristics.

A 2D representation of :

- **A punch holder** : A polygon which does not move over the time.
- **A stripper** : A polygon that comes to fix a part of the metal sheet.
- **A punch die** : A polygon that we know the position over the time.
- **A metal sheet** : With its fixed thickness, it is described by its neutral axis with well known characteristics.

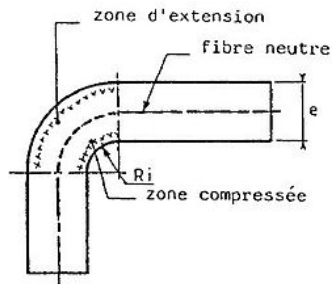


Figure : Neutral axis

In order to have a realistic representation of the bending process we will cut the problem into two parts :

- ① XML scene representation containing :
  - Static parts geometry and position.
  - The material characteristics.
  - The boundary conditions.
  - The punch die geometry and position at every step.
- ② A finite element solver using Open fem :
  - Takes a step disposition and strengths applied to the metal sheet.
  - Return the new metal sheet shape.

## For each step

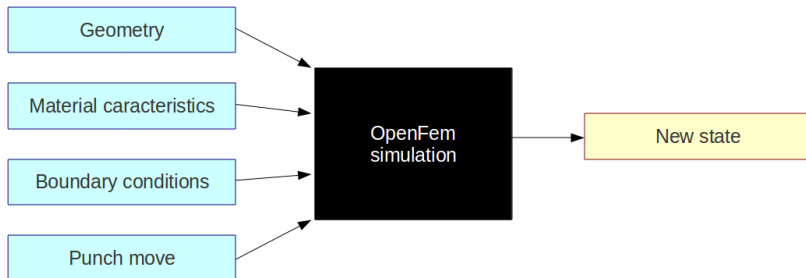


Figure : Dialog between Open fem and internal scene representation

In a one operation cycle we will allow the user to :

- Define the system's initial state.
- Indicate the simulation's parameters.
- Visualize all the simulation steps.
- Visualize the trajectories of the free parts of the metal sheet.
- Visualize the distance between two points at a given step.
- Follow a given point over the time.



Figure : The graphical user interface

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  - Tasks repartition
  - Tasks completion
- 4 Conclusion

## Gantt diagram

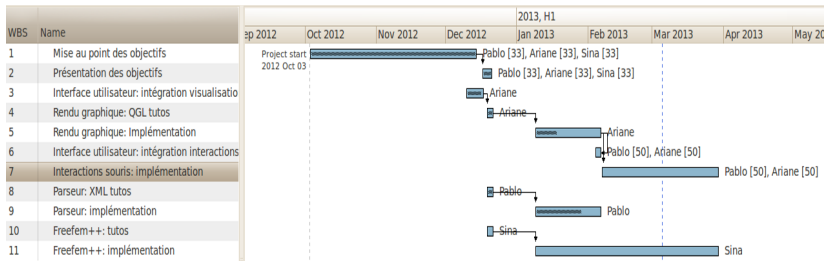


Figure : Gantt Diagram



- MCS : handles open fem  
Compute the metal sheet's deformation at every step.
- ICAO : visual rendering.  
Graphical user interface and interaction.
- ICAO : XML scene description and parser.  
Communication with open fem.

## Tasks repartition

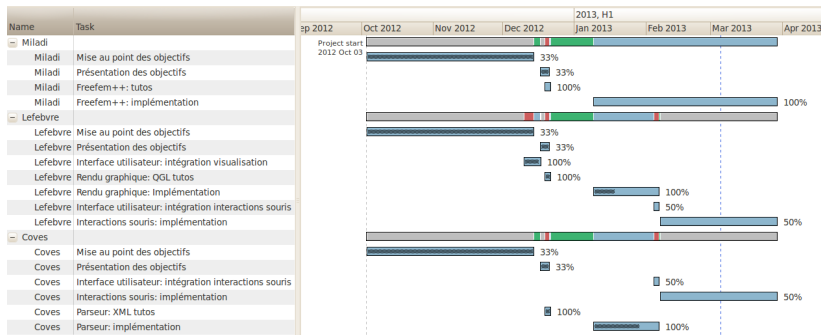


Figure : Tasks repartition

## Tasks completion

WBS	Name	Start	Finish	Work	Duration	Slack	Cost	Assigned to	% Complete
1	Mise au point des objectifs	Oct 3	Dec 14	52d	52d 3h	70d 3h	0	Pablo, Ariane, Sina	100
2	Présentation des objectifs	Dec 17	Dec 21	4d	4d	70d 6h	0	Pablo, Ariane, Sina	100
3	Interface utilisateur: intégration visualisation	Dec 10	Dec 17	6d	6d	13d	0	Ariane	90
4	Rendu graphique: QGL tutos	Dec 19	Dec 21	3d	3d	10d	0	Ariane	100
5	Rendu graphique: Implémentation	Jan 9	Feb 6	21d	21d		0	Ariane	33
6	Interface utilisateur: intégration interactions souris	Feb 4	Feb 6	3d	3d		0	Pablo, Ariane	0
7	Interactions souris: implémentation	Feb 7	Mar 29	37d	37d		0	Pablo, Ariane	0
8	Parseur: XML tutos	Dec 19	Dec 21	3d	3d	49d	0	Pablo	100
9	Parseur: implémentation	Jan 9	Feb 6	21d	21d	37d	0	Pablo	70
10	Freefem++: tutos	Dec 19	Dec 21	3d	3d	12d	0	Sina	0
11	Freefem++: implémentation	Jan 9	Mar 29	58d	58d		0	Sina	0

Figure : Tasks completion

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  - Possibilities
  - Questions

- Take sheet metal thickness modification into account.
- Evaluate spring back compensation to modify punch and die geometries.

Thank you for your attention.

Any questions?