

Simplify Advanced CAE Tools for Simulation Driven Product Development

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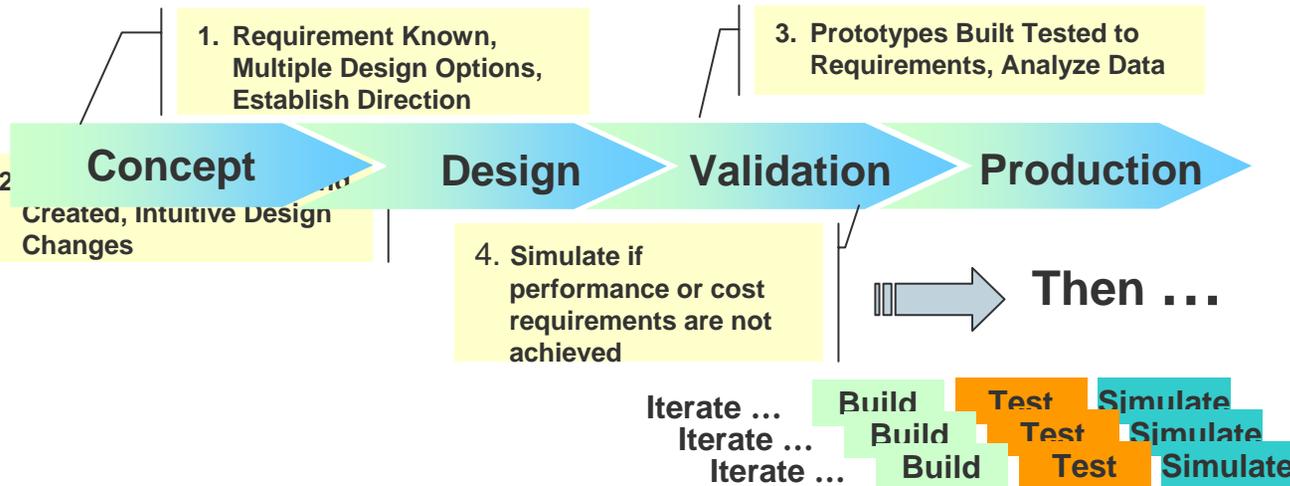
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Outline

- Simulation Driven Product Development
- Simplify FEA in IDEAS – EZ_FEA
- Simplify ESC in IDEAS – EZ_ESC
- Summary

Simulation Driven Product Development

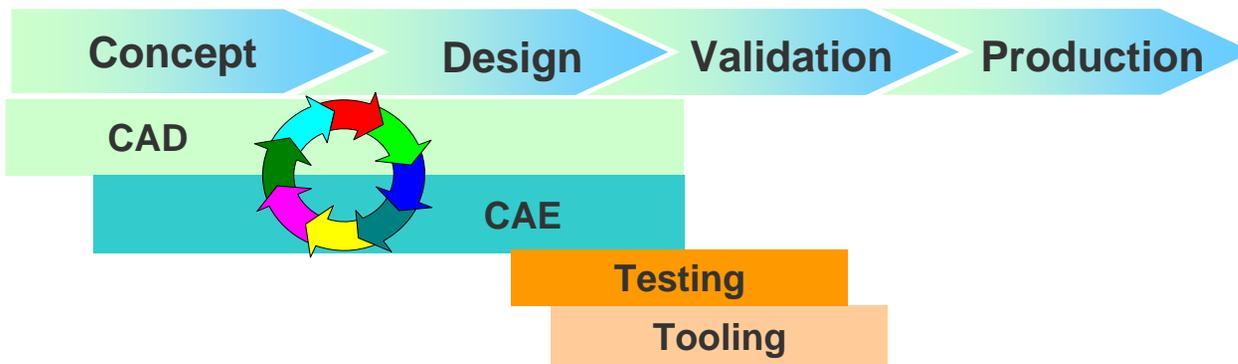
Traditional Design



- Too many prototypes
- Long TTM
- High cost

- Major Improvements:
 - > Computer HW
 - > Simulation tech.
 - > New CAE SW

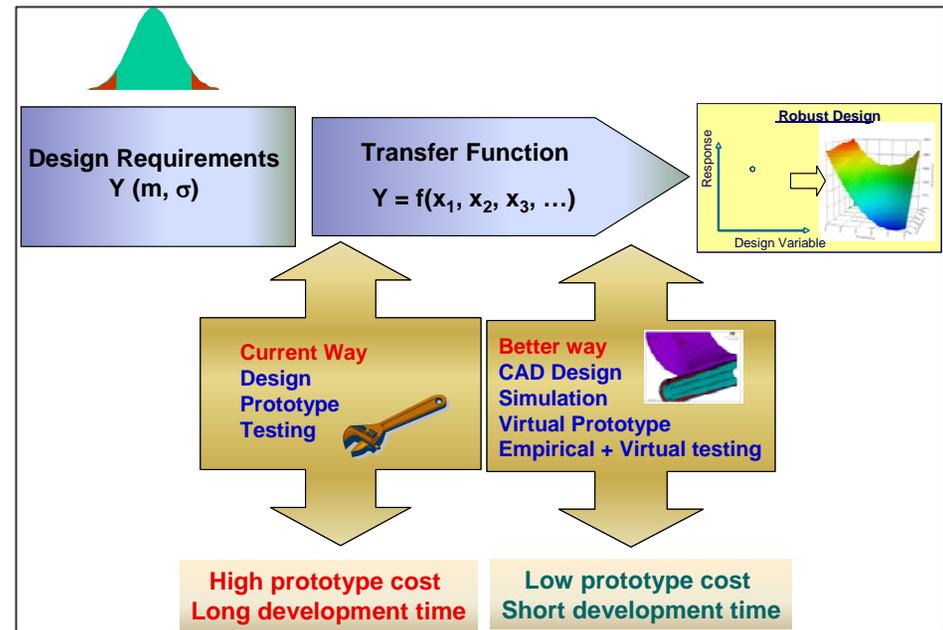
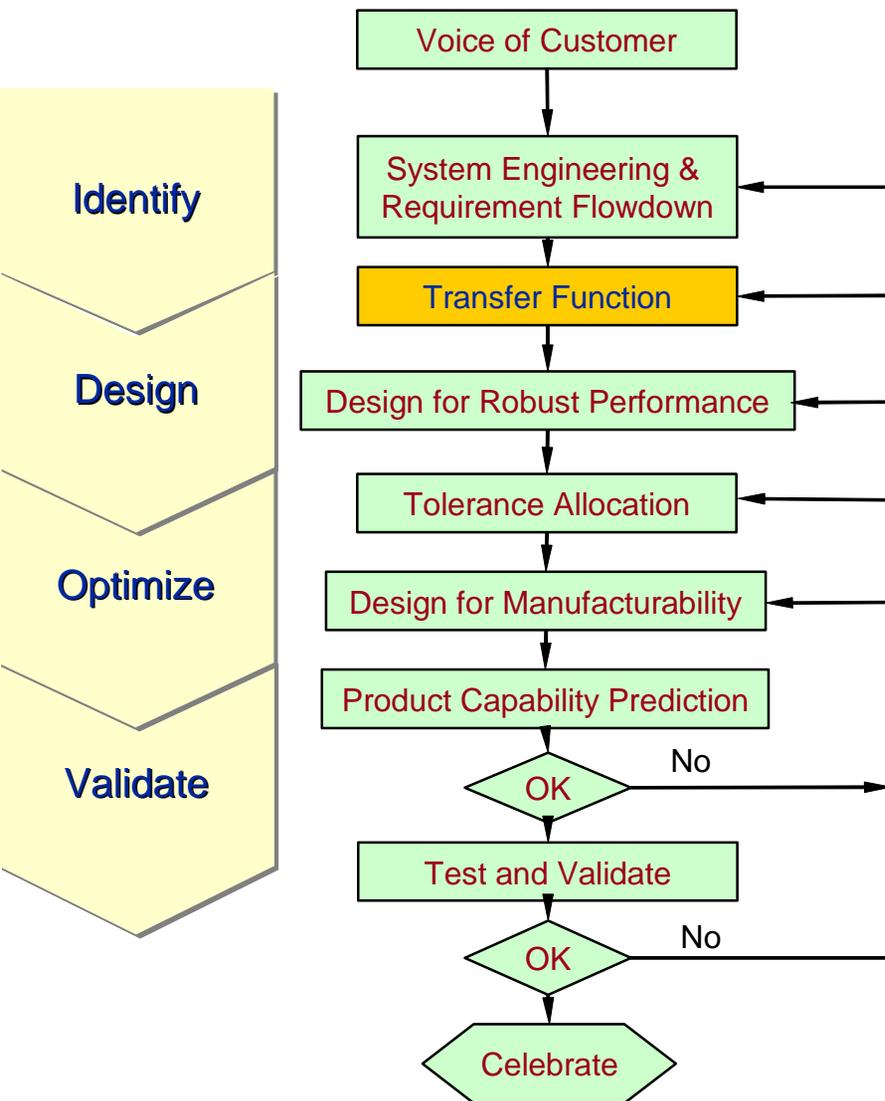
Simulation Based Design



- Fewer prototypes
- Shorter TTM
- Better products

Apply simulation at the early stage of design.

Simulation in Design for Lean Six Sigma



Simulation Tools

CAD (IDEAS Master Modeler)

CAE

Tooling

Test

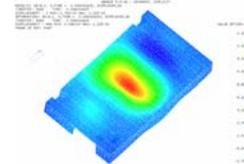


First Order Analysis

- TK Solver (Equation solver)
- DE/CAASE (Simple analysis)
- Cognition (Tolerance)

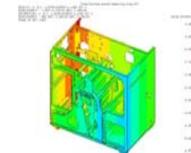
Basic Analysis

- IDEAS/Simulation (finite element)
- EZ_FEA
- EZ_ESC
- NIP_FEA
- ANSYS/Workbench (finite element)
- VisualNastran (motion + structure)



Advanced Simulation

- ABAQUS (Nonlinear finite element analysis)
- ANSYS (Multiphysics)
- NASTRAN (Structural dynamics)
- FLUENT (Fluid/Thermal analysis)
- ADAMS (Motion simulation)
- Recurdyne (3-D motion in media Handling)



Simplify IDEAS for Early CAE – EZ_FEA and EZ_ESC

- IDEAS has been proved to be a powerful simulation tool for analysts.
- Designers and engineers with limited simulation background find it hard to use due to it's steep learning curve.
- Many structural problems at the early stage of design can be solved by a linear elastic FEA tool for single part.
- Many thermal and air flow problems at the early stage of design can be solved by a ESC tool for simple geometry.
- IDEAS Windows environment makes it possible to simplify the GUI for simple problems.

Simplify FEA in IDEAS – EZ_FEA

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Customize IDEAS for EZ_FEA

Objective

To simplify finite element analysis in IDEAS by developing an wizard-based, easy-to-use graphic user interface for IDEAS solver.

IDEAS/Simulation for designers and engineers

IDEAS is the standardized CAD/CAE tool in Xerox. IDEAS/simulation is a powerful simulation tool but was designed for analysts with formal education in engineering analysis. For casual users who want to perform simple analysis, it has the following shortcomings:

- No direction to follow when using the tool.
- Too many buttons and sub panels – hard to remember.
- Too many forms designed in analyst's language.

As the result, the usage of IDEAS/Simulation in product teams has been low.

I-DEAS / EZ_FEA – Features

- To simplify the analysis process in IDEAS, We developed IDEAS/EZ_FEA using IDEAS Windows Native User Interface for designers/engineers to perform basic FEA.
- The main features of IDEAS/EZ_FEA:
 - Windows-look Graphic User Interface
 - Wizard-like guidance with six simple steps to follow
 - Fewer, organized buttons to perform a series of tasks
 - No complex forms to fill
 - The current version focus on linear/static FEA for single solid models. More feature are to be developed.

IDEAS / EZ_FEA – Features

The image shows a screenshot of the IDEAS / EZ_FEA software interface. The main window displays a 3D finite element mesh of a mechanical part. Several callout boxes highlight specific features:

- Windows Look:** A yellow box pointing to the top menu bar (File, Edit, View, Options, Tools) and the toolbar.
- Simple buttons for each tasks:** A yellow box pointing to a vertical list of task steps on the left side of the interface.
- Fewer buttons:** A yellow box pointing to a simplified toolbar on the right side of the interface.
- Step-by-step guidance:** A yellow box pointing to the 3D mesh, indicating the software's guided workflow.
- Simple user input replaces complex forms:** A yellow box pointing to a text input field at the bottom of the interface.

The task list on the left includes:

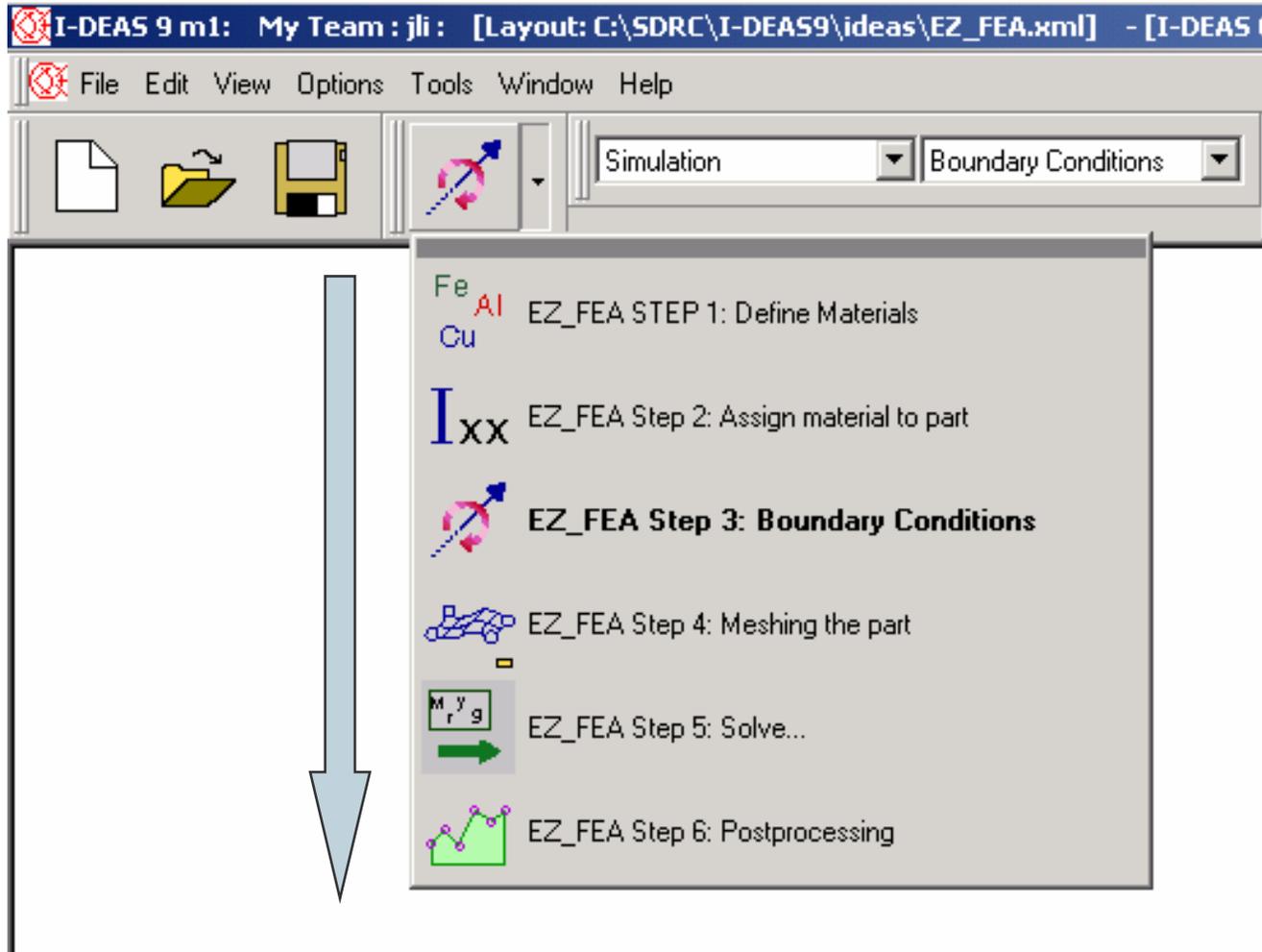
- Fe Al EZ_FEA STEP 1: Define Materials
- Cu EZ_FEA Step 2: Assign material to part
- I_{XX} EZ_FEA Step 3: **Boundary Conditions**
- EZ_FEA Step 4: Meshing the part
- EZ_FEA Step 5: Solve...
- EZ_FEA Step 6: Postprocessing

The text input field at the bottom contains the following text:

```
Selected 1821 entities. Use "Highlight_Selection" to  
total elements deleted : 0  
15 - WHITE  
Enter background color name or no. (0-BLACK)  
?  
Enter background color name or no. (0-BLACK)  
15
```

I-DEAS / EZ_FEA – Steps

- Follow six step to complete the analysis



I-DEAS / EZ_FEA – Buttons

A sequence of clicks in each step:

- Only a few buttons to click from left to right in each step.
- Each button contains optimized options for basic analysis

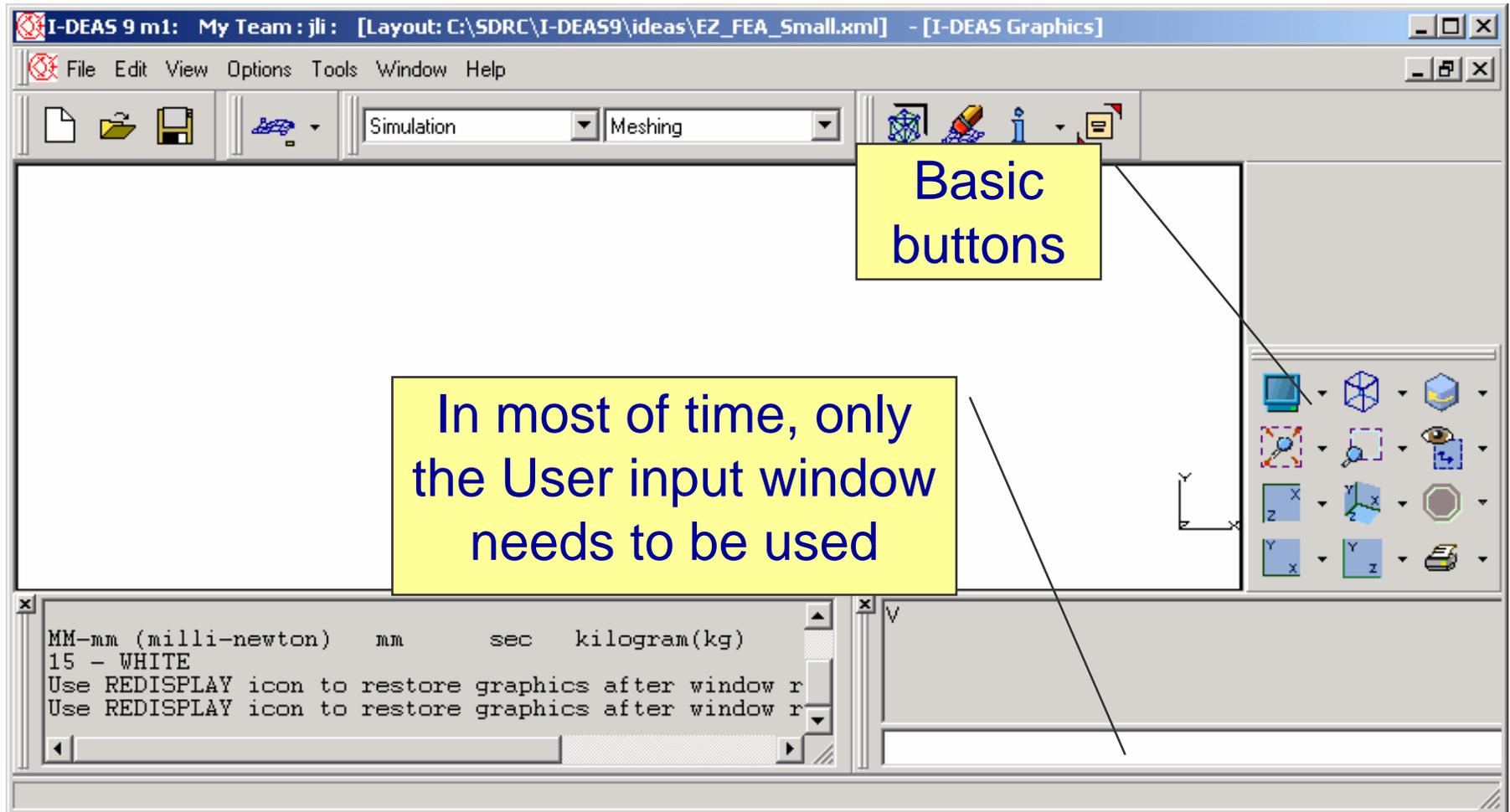


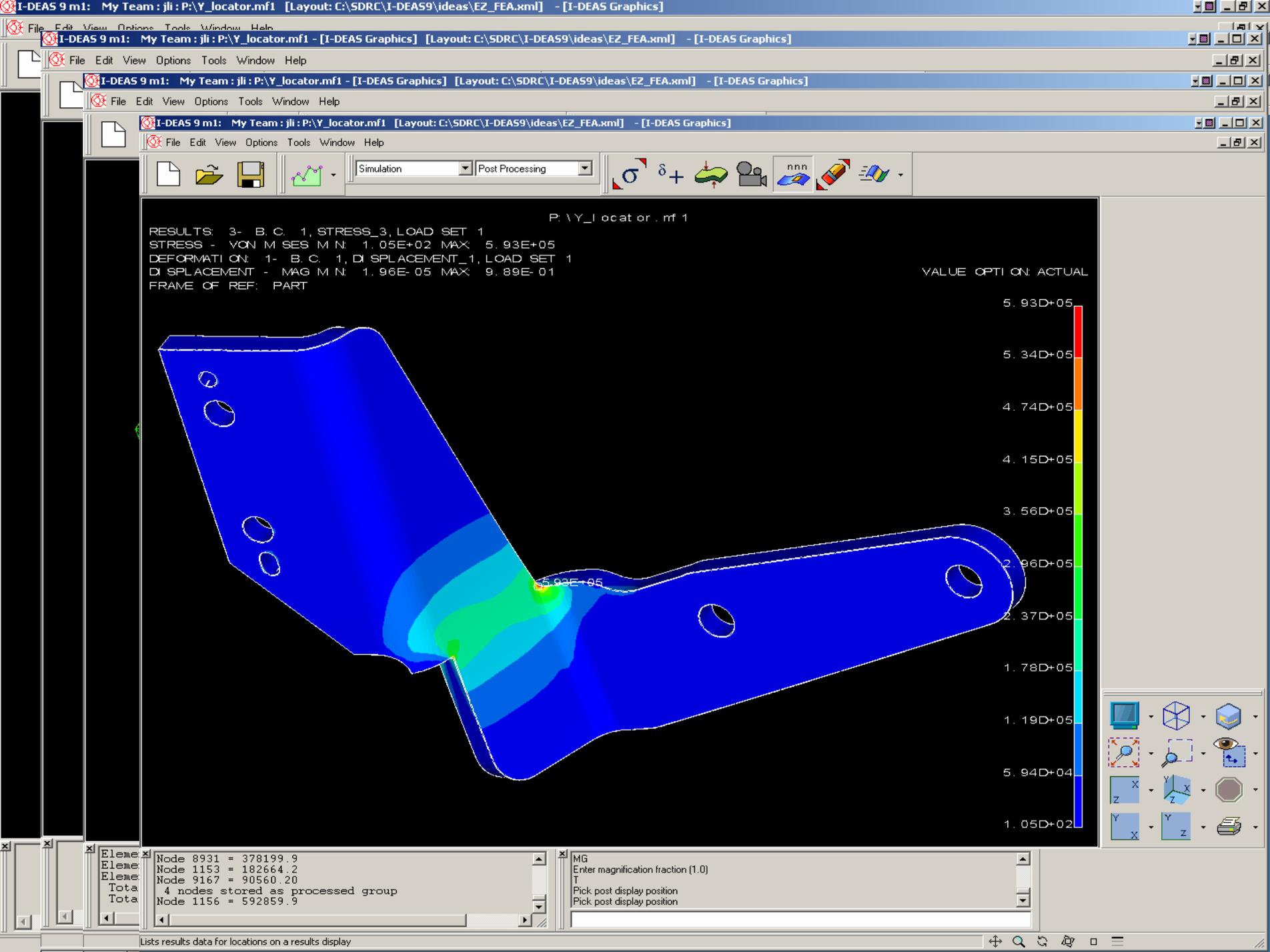
Flow Direction



I-DEAS / EZ_FEA – Forms

No complex forms to fill:

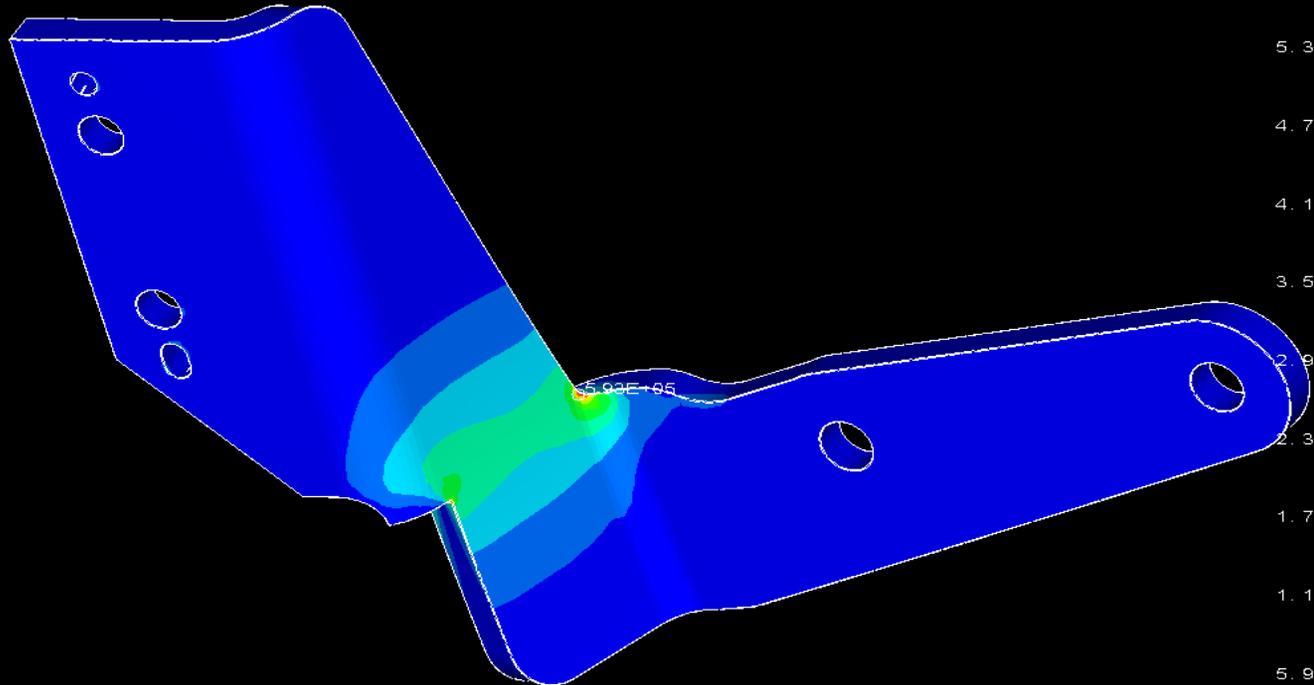




P:\Y_locator.mf1

RESULTS: 3- B. C. 1, STRESS_3, LOAD SET 1
STRESS - VON MISES M N. 1.05E+02 MAX: 5.93E+05
DEFORMATION: 1- B. C. 1, DISPLACEMENT_1, LOAD SET 1
DISPLACEMENT - MAG M N. 1.96E-05 MAX: 9.89E-01
FRAME OF REF: PART

VALUE OPTION: ACTUAL



Elem 8931 = 378199.9
Elem 1153 = 182664.2
Elem 9167 = 90560.20
Total 4 nodes stored as processed group
Node 1156 = 592859.9

MG
Enter magnification fraction (1.0)
T
Pick post display position
Pick post display position

Lists results data for locations on a results display

Simplify thermal/Fluid Analysis in IDEAS – EZ_ESC

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Background

- With the success in EZ_FEA, there are requests from Xerox mechanical designers and engineers for an easy-to-use tool to do thermal and airflow analysis.
- Thermal and airflow analysis generally requires substantial fundamental mechanical knowledge.
- The existing thermal and airflow CAE tools are designed for analysts thus has a steep learning curve for designers and engineers.

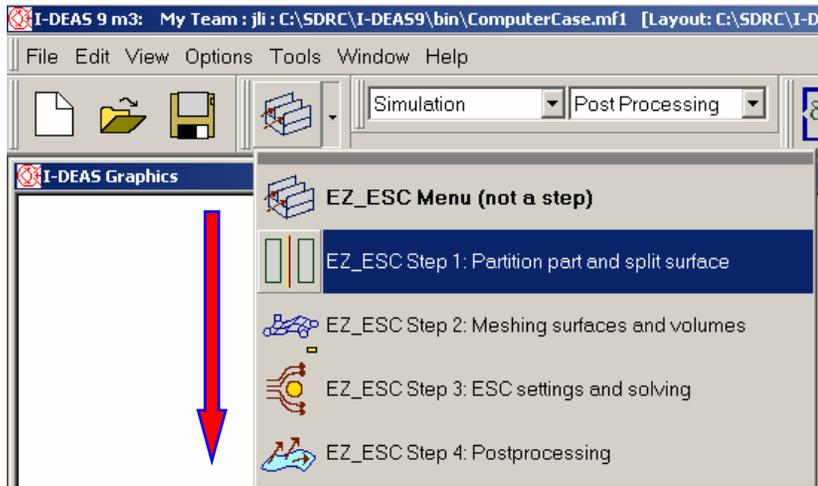
Objectives

- Open the door of thermal and airflow analysis to mechanical designers by providing them an easy to use CAE tool.
- Develop a wizard-based, customized ESC with simplified user interface, while still have the major ability of thermal and airflow analysis.
- Hide most of the fundamental knowledge behind the user interface of the CAE tool so a user with limited mechanical background can use it.
- By allowing designers to do some simple thermal and airflow analysis, the product development time will be shortened and product quality will be improved since there is time to do more design iterations.

Features

- The main features of IDEAS/EZ_ESC:
 - Windows-look Graphic User Interface
 - Wizard-like guidance with six simple steps to follow
 - Fewer, organized buttons to perform a series of tasks
 - No complex forms to fill
- The flexibility of native IDEAS ESC tool was sacrificed by use of the simplified GUI.

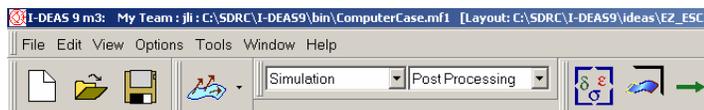
Features



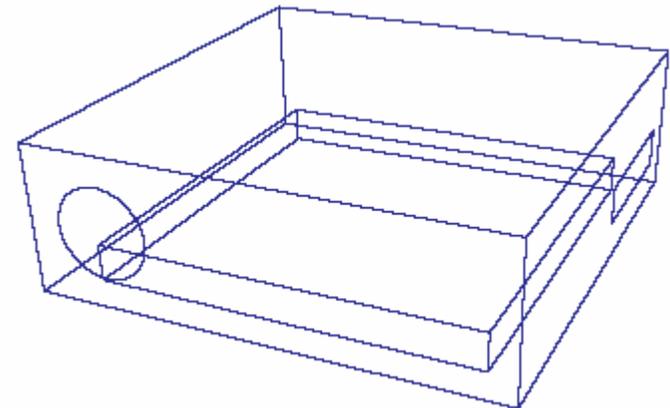
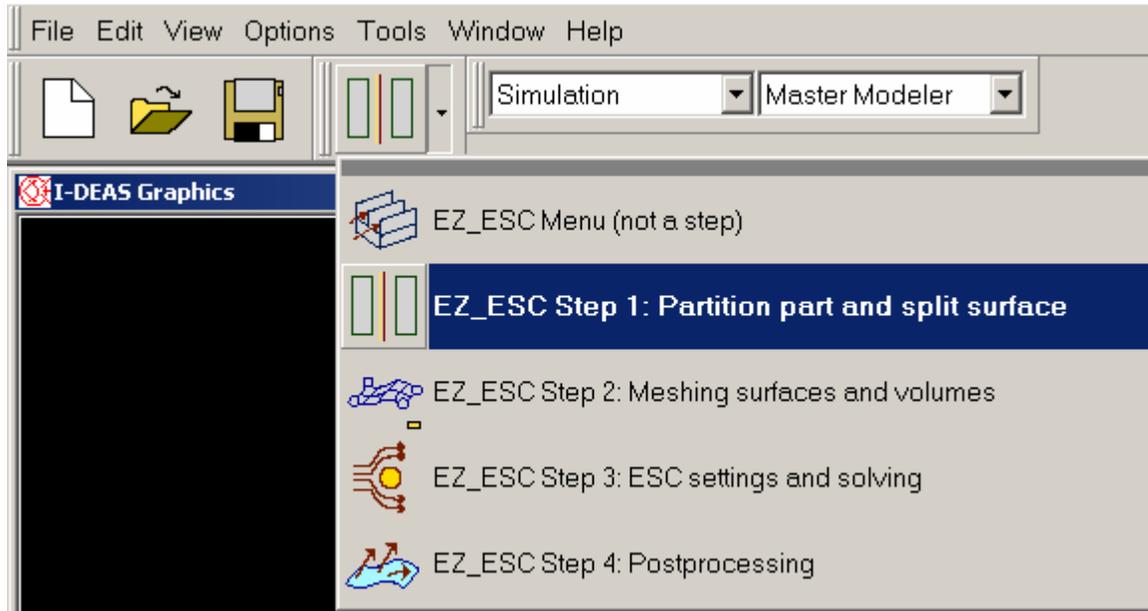
A simple ESC simulation can be done by following the six steps from top to bottom.

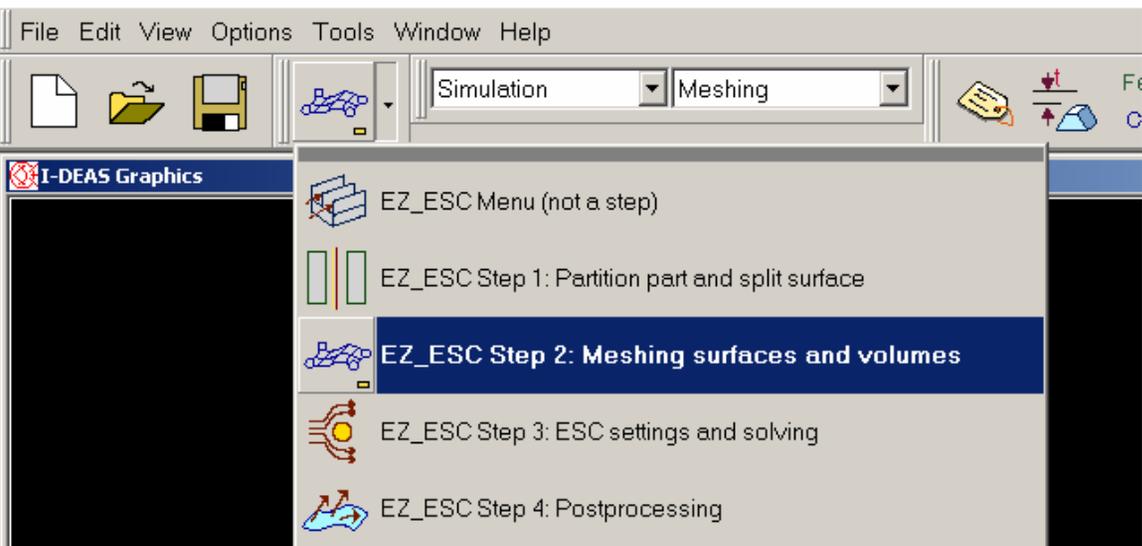
- Step 1 'Partition part and split surface' is familiar IDEAS CAD users. The GUI is the same as the regular IDEAS/Master Modeler.
- Each of the following step includes several required buttons arranged from left to right. The user is required to click the buttons in that order. In some button clicks, some inputs or simple forms need to be filled, but the complicated forms and knowledge-based items are eliminated by background script codes.

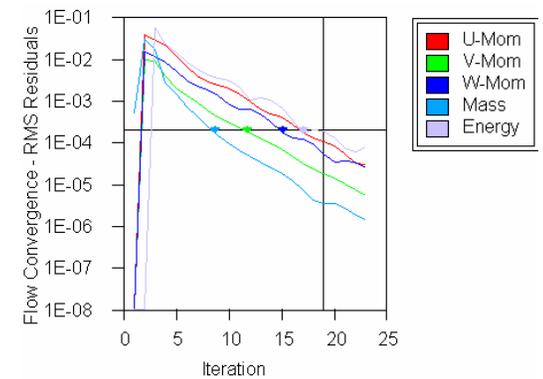
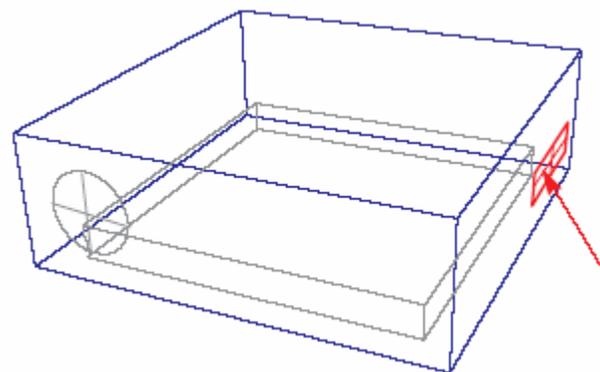
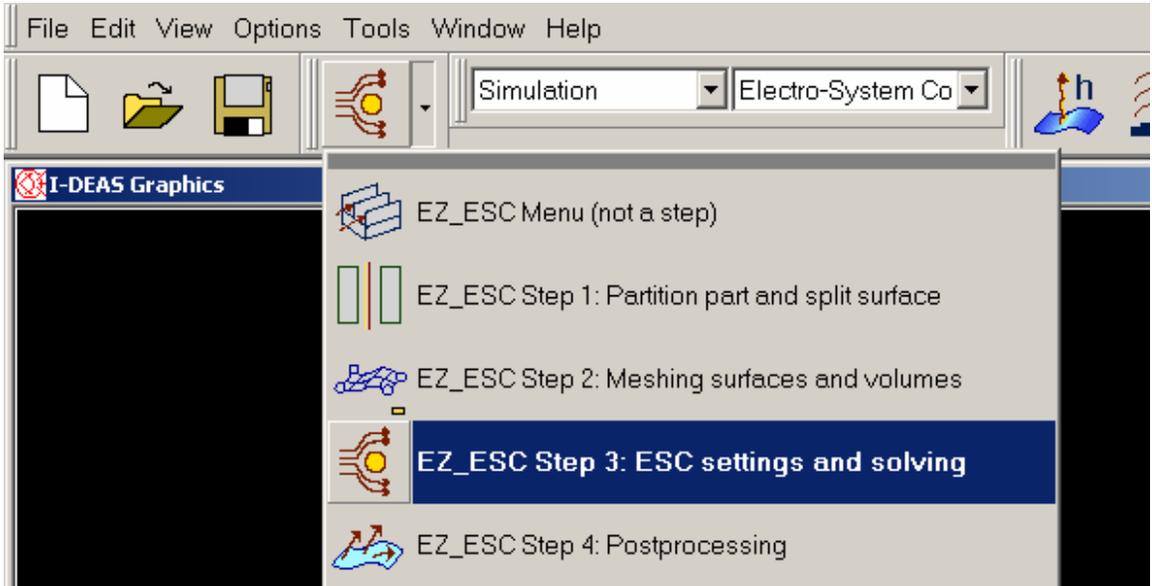
- Step 2: Meshing surfaces and volumes
- Step 3: ESC settings and solving
- Step 4: Postprocessing

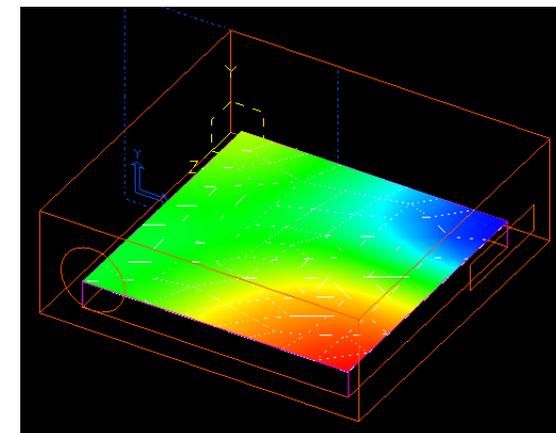
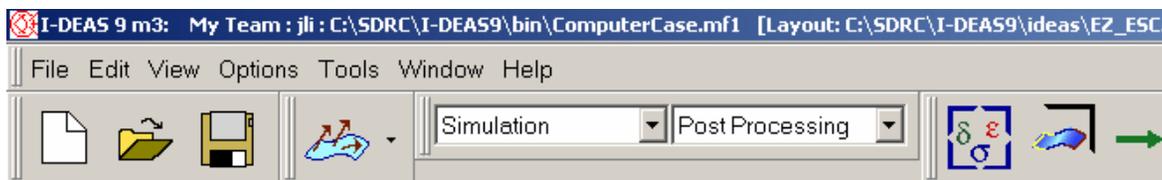
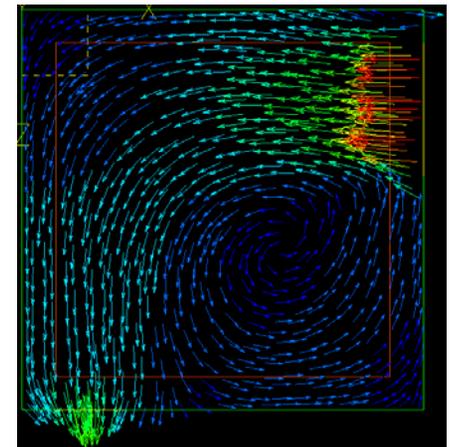
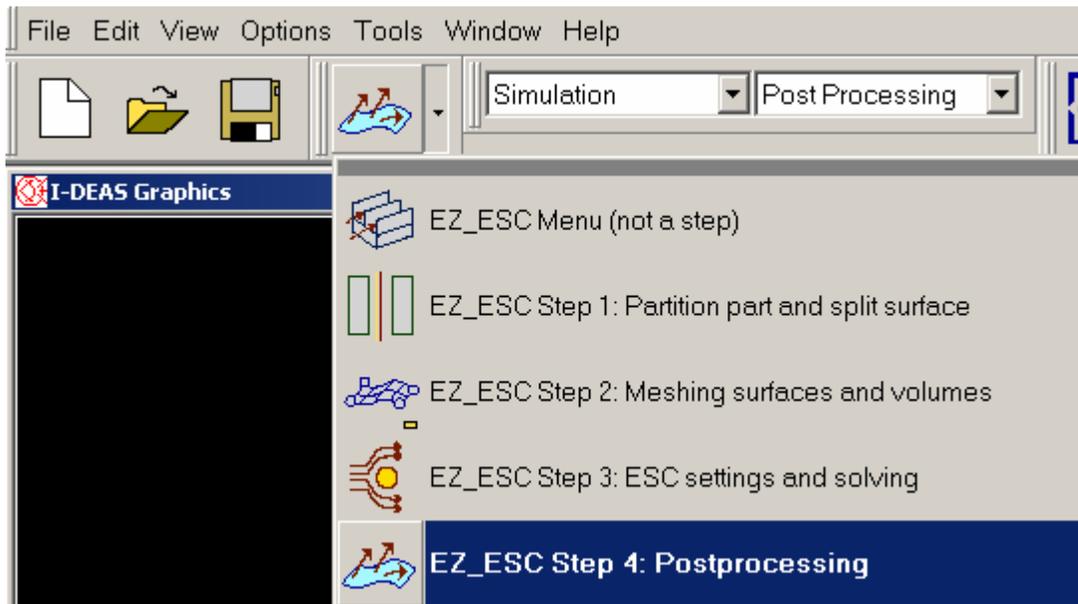


Features









Summary

- IDEAS/EZ_FEA and IDEAS/EZ_ESC are designed for designers and engineers for basic analysis in product design.
- They are wizard-based tools in Windows environment.
- They filtered many features of IDEAS/FEA and IDEAS/ESC and reorganized the steps, buttons and forms, thus greatly simplified the operation for FEA and ESC analysis.
- The simplified GUI makes it possible for new or casual users to effectively perform basic FEA and ESC analysis in Xerox product development.
- They are embedded in IDEAS thus no file transfer is required comparing to other easy-to-use CAE tools.
- There is extra cost to deploy this tool.
- More design engineers will be engaged in simulation based design due to their easy-to-use user interface.
- It will benefit Xerox product development in reducing prototype cost, shortening time to market and improving product quality.