

基於 Tcl/Tk 和 Python 開發 3C 產品的流程自動化

Base on Tcl/Tk and Python to Develop the Process Automation of 3C Product Simulation

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摘要

近年來 CAE 技術局限於電腦設備，很難進一步縮短運算時間，仍需耗費許多開發成本，且現今市場競爭激烈，如何最快找到 solution，已成產品開發的重要課題。因此，本文以縮短繁瑣的操作設定為目標，利用程式語言 Tcl/Tk 和 Python 編寫程式運用於產品的流程自動化，建立一條龍的模擬流程，可有效的降低開發成。

自動化程式也能降低使用者操作上的難度，大幅度降低學習的難易度，使新人較容易上手，減少人為的疏失和錯誤，並可使每次分析達到一致性的品質。

關鍵字：流程自動化、Python、Tcl/Tk、Abaqus

ABSTRACT

In these few years, CAE technology is restricted by computer equipment. It is difficult to reduce the calculation time, causing the cost of time still quite expensive in CAE. Nowadays, due to competitive market, to quickly find solution has become an important issue in product development. Therefore, we are looking forward to simplify the simulation process by using Tcl/Tk and Python coding. Create "Consistent Production Process" to reduce time of user handling manually in the CAE process can help reduce cost of development effectively. At the same time, the process automation can cut off some difficulties for the newcomer, making it easier for them to learn, and decreasing human mistakes and increase the quality of control in every simulation.

Keywords: Process Automation, Python, Tcl/Tk, Abaqus

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Motivation

In these few years, CAE is restricted by computer equipment. It is difficult to reduce the calculation time, causing the cost of time still quite expensive.

Coding
TCL/TK Python → Cost Down
Time human

Geometry → Mesh → Shock Simulation
Drop Simulation

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Simulation Process

PRO-E → MESH → Import Abaqus → Modeling → Computing → Report

Excel VBA

- 整理Part名稱

1. Mesh Tool

- Auto Rename
- Name Modification
- Property build

2. Tool Tree

- 檢查COMP名稱、元素品質和 Update Element Type...等
- 自動Coupling
- 輸出INP file

3. 平自動Coupling

- 自動設定衝擊(Qstrain)和落排

4. 自動設定衝擊(Qstrain)和落排

5. Criteria Review - 自動找出issue位置

6. 半自動輸出模擬報告

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Simulation Process – PROE

PRO-E 利用Excel VBA快速修改Part名稱，使其包含斷面性質和材料的字符。

Part Name	Mesh Name
IC3A01_ME_LOWER_CASE	IC3A01_ME_LOWER_CASE_MESH_P122
IC3A01_FRONT_BRE1	IC3A01_FRONT_BRE1_MESH_P122
MANIPOLD_SOLID_BREP_30905	MANIPOLD_SOLID_BREP_30905_MESH_P122
IC3A01_MB_BRE1_T09	IC3A01_MB_BRE1_T09_MESH_P122
IC3A01_MB_BRE1_C09B	IC3A01_MB_BRE1_C09B_MESH_P122
MANIPOLD_SOLID_BREP_34490	MANIPOLD_SOLID_BREP_34490_MESH_P122
MANIPOLD_SOLID_BREP_32588	MANIPOLD_SOLID_BREP_32588_MESH_P122
IC3A01_ME_J06_COVER	IC3A01_ME_J06_COVER_MESH_P122
IC3A01_O01_BRE1	IC3A01_O01_BRE1_MESH_P122
MANIPOLD_SOLID_BREP_35375	MANIPOLD_SOLID_BREP_35375_MESH_P122
MANIPOLD_SOLID_BREP_35381	MANIPOLD_SOLID_BREP_35381_MESH_P122
IC3A01_P01_COVER	IC3A01_P01_COVER_MESH_P122
IC3A01_P01_BRE1_B09	IC3A01_P01_BRE1_B09_MESH_P122
IC3A01_O01_LOCK	IC3A01_O01_LOCK_MESH_P122
IC3A01_ME_FRONT_BRE1	IC3A01_ME_FRONT_BRE1_MESH_P122
IS002_1_1	IS002_1_1_MESH_P122
IS002_1_2	IS002_1_2_MESH_P122
IS002_1_3	IS002_1_3_MESH_P122
ATX_POWER_2_1_MESH_P122	ATX_POWER_2_1_MESH_P122
3_020701_3_020701_MESH_P122	3_020701_3_020701_MESH_P122

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Simulation Process – Mesh

MESH

1. Mesh Tool

- Auto Rename - 根據上一頁的Excel VBA得到的名稱，快速修改COMP名稱。
- Name Modification - 建立GUI介面讓User快速修改名稱。
- Property build - 自動建立Material and Property，並Update至COMP。

Mask | Mode | Mesh | Tool Tree

Auto Rename
Name Modification
Property Build

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MESH

- Quickly rename.
- Provide a panel to quickly modify name of material and property.
- Auto create material and property.

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Simulation Process – Import Abaqus

Import Abaqus

2. Tool Tree

- 檢查COMP名稱、元素品質和Update Element Type...等
- 自動Coupling
- 輸出INP file

Automation

- Model check
 - Name check
 - 2D Element Quality check
 - 3D Element Quality check
 - Update Element
 - Edge check
 - Property check
- Setting
 - Auto Coupling
 - Coupling
- Output
 - Output INP

檢查Mesh Model品質

自動鎖螺絲

輸出INP檔至Abaqus

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Simulation Process – Import Abaqus

Import Abaqus

Auto check part name, element, edge, property and material.

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Simulation Process – Import Abaqus

Import Abaqus

Auto find screw hole and do coupling.

Do auto coupling

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Simulation Process – Import Abaqus

Import Abaqus

模型建立→ HyperMesh
工況設定和分析→ Abaqus

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Simulation Process – Modeling

Modeling

3. 半自動Coupling

4. 自動設定衝擊(Qstrain)和落序

自動設定前序步驟的落序以獲得最少應力和Data輸出等

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Simulation Process – Modeling

Modeling

There are still some missing coupling existed.
In order to do coupling quickly, so this plug-in is developed.

3. 半自動Coupling

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Simulation Process – Modeling

Auto setup parameters and orientation of shock test.

Modeling

4. 自動設定衝擊(Qstrain)和落排

Auto shock setup

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Simulation Process – Modeling

Report

5. CriteriaReview - 自動找出issue位置
6. 半自動輸出模擬報告

自動讀取結果檔，並依據已設定的Criteria檢查模型，可得到應力集中的位置(結構破壞位置)自動生成報告對面並擷取圖片和動畫放置PPT。

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Automatic read the result file and then, according to the criteria by strain of user setup to search and highlight the failure position.

Report

6. CriteriaReviewer : 自動找出issue位置

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Video convert to GIF file and then auto output to ppt.

Report

7. 半自動輸出模擬報告

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The End

Thanks for your attention

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