First Order Analysis (FOA) Using Microsoft Excel Link to ANSYS Parametric Design Language (APDL)

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Abstract

The purpose of this paper is to define the alternative method of designing stage by applying First Order Analysis method of structure to obtain close to right design quickly to provide an overview of structure performance of general mechanical system, utilizing the Microsoft Excel as the interface of structure which conclude macro language and illusion of structure vehicle part to be change , link to ANSYS Parametric Design Language (APDL) software as macro language allowing the structure to generate as request designer of the structure. Involved in this study is the structure of vehicle four by four-part variable change as command.

Keywords: First order analysis, ANSYS Parametric Language Design (APDL)

1 INTRODUCTION

Computer Aided Engineering (CAE) has been used to estimate the performance of vehicle structure. However, Computer Aided Engineering (CAE) is impractical at the initial design stage due to it sophisticated, and complex functions and characteristic. To overcome this issues, First Order Analysis (FOA) is introduced to obtain close to right design quickly to provide an overview of structure performance of general mechanical system, it will be linked to ANSYS Parametric Design language (APDL) to generate stress results.

Utilized Microsoft excel as interface which allow to change the structure dimension

2 Literature

I. First Order analysis (FOA)

FOA is a method of structural analysis that doesn't consider the deformed shape of the structure to arrive at the internal actions of the structure. This method utilization accepted technique, for example design structure automobile body design, the additionally furnish graphical interface for the assortment of outline architects can effectively comprehend without any additional preparation. FOA used to the preparation prepare and helpful to the costumer. It's an equipment for performing action

Using FOA, any concept alteration may be eliminated change easily. Due that the calculation of properties and design parametric optimization will be obtain easily. Figure 2.1 and figure 2.2 shown the example of FOA which apply using Microsoft excel as a dashboard for graphical interface to create view for the body engineer to review and understand, furthermore in determining the best combination for the application and to apply engineer ideas in design procedure. Calculation function that can be implemented from every part, function for calculation the properties of product made by combining elements and part form due to layout parameter optimization. used optimizing the parameter of a structure in stage to forget the system that devour time.(Nishigaki, Nishiwaki, Amago, Kojima, & Tsurumi, 2002)

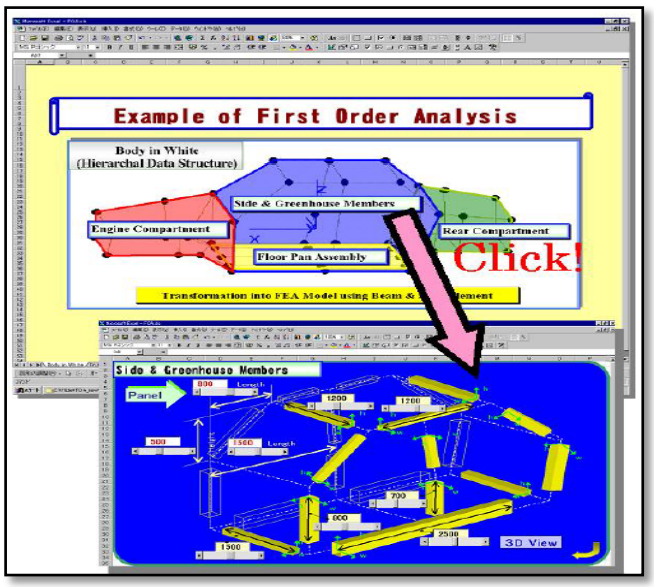


Figure 2.1: Simple example of FOA

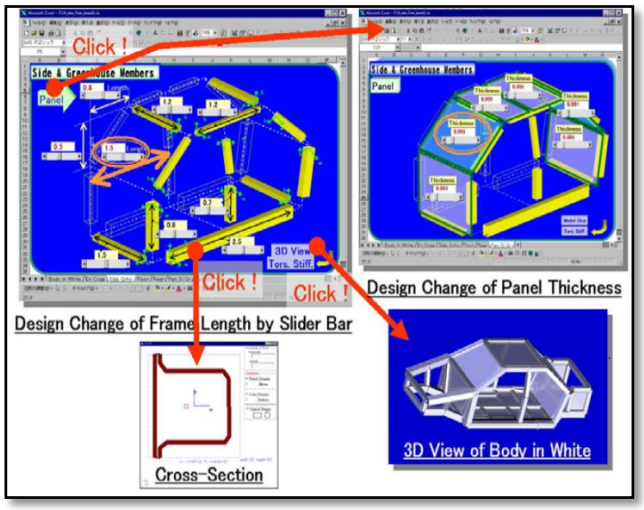


Figure 2.2: Simple example of FOA

II. Microsoft Excel interface

Excel is accessible software because it has large spreadsheets that allow for better storage and modification of information can be generate. it has programming aspect, visual basic for programs, allowing user to appoint a wide form of numerical approach, for instance, solving differential equation of mathematic physics, and reporting returned to the spreadsheet.

III. Graphic User Interface (GUI)

GUI operating system advantage it`s greater accessibility by giving lots of capability at cursor tip and has lower cognitive lode. This operating system can be use without significant training to operate software. GUI operating system also offer a simple and multitasking which users can maintain multiple open application and transition between them with clicking of the mouse, furthermore this GUI operating systems provide the end-user with less control over the operating and file system than a comparable Command Line Interface (CLI) system

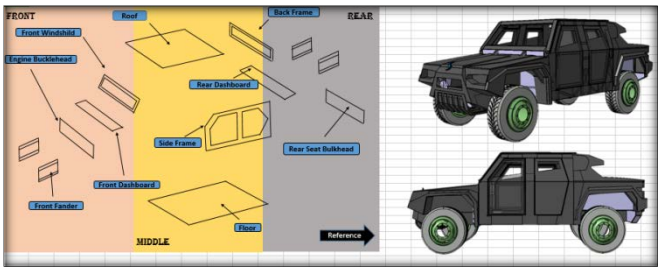


Figure 2.3: Interface menu

IV. ANSYS Parametric Language Design (APDL)

ANSYS or Analysis of System software, provide a practical help to those who embark on the road leading to effective in solving engineering problems and referring to the structural Finite Element Analysis (FEA) which enables to simulate tests or working conditions, enables to test in virtual environment before manufacturing prototypes of products. Furthermore, determining and improving weak points, computing life and predicting probable problems are possible by 3D simulations in virtual environment.

ANSYS commands in a macro file. Creating a macro enables to custom referring appendix, in effect, creating own custom ANSYS command. For example, calculating structure mash which force applied at stricture, would require a series of ANSYS commands in the postprocessor. By recording this set of commands in a macro, generate a new, single command that executes all of the commands required for that calculation. In addition to executing a series of ANSYS commands, a macro can call GUI functions or pass values into argument.

Nest macros. That is, one macro can call a second macro, the second macro can call a third macro, and so on. 20 nesting levels, including any file switches caused by the ANSYS /INPUT command. After each nested macro executes, the ANSYS program returns control to the previous macro level.
Macro language can be creating in text editor to create or edit macro files. Any ASCII editor will work. Moreover, ANSYS macros can have their lines terminated by either UNIX or Windows line ending conventions note pad or any software has .txt format that APDL can read. Those command at appendix.

Figure 2.4: ANSYS Lunch interface

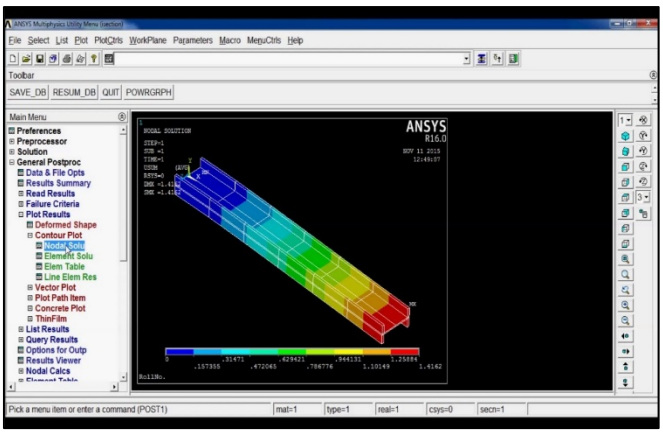
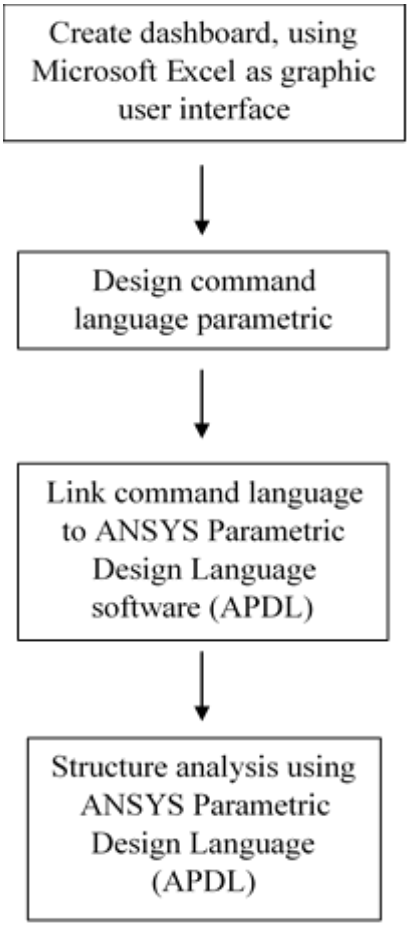


Figure 2.5: ANSYS Parametric Language Design (APDL) interface

3 Methodology



I. Graphic User Interface (GUI)

Dashboard of the GUI had been implement in Microsoft Excel 2016. Objective is to automate the parameter in every compartment to generate command and save in Notepad .TXT/ASCII format.

I. Dashboard design
II. Compartment of four by four vehicle
III. Command design
IV. Generate structure

Every section has been assign to front, middle and rear compartment, every section has their own part. Futhermore, Refference button as command refference

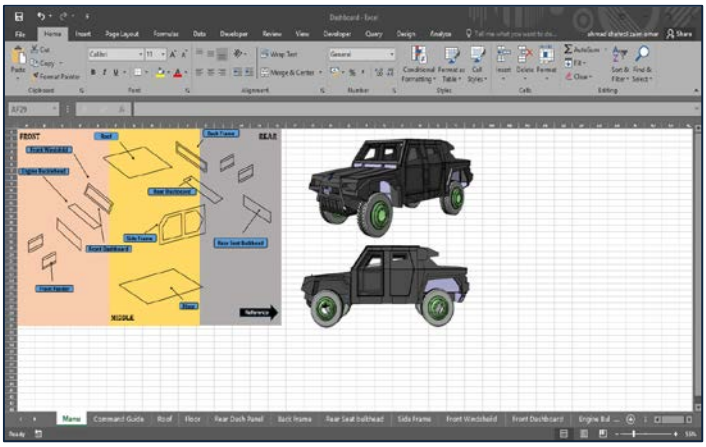


Figure 3.1: Dashboard design.

X, Y and Z has been assigned for Width, Thickness and Length and used to represent each of parameter of the compartment of Roof, as shown in Figure 3.2.1.2. when the assigned parameter mentioned changes, the command column also changes automatically to produce a graphical representation of the parameters.

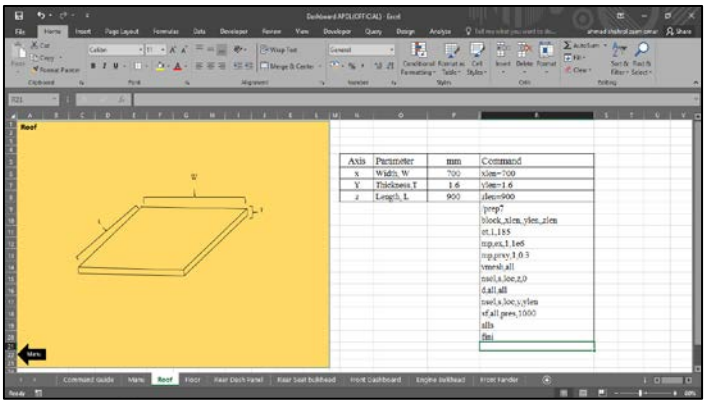


Figure 3.2: Compartment Interface

Command that been saved, appeared at desktop as .txt file name “data”, by double clicking the file to double check the command

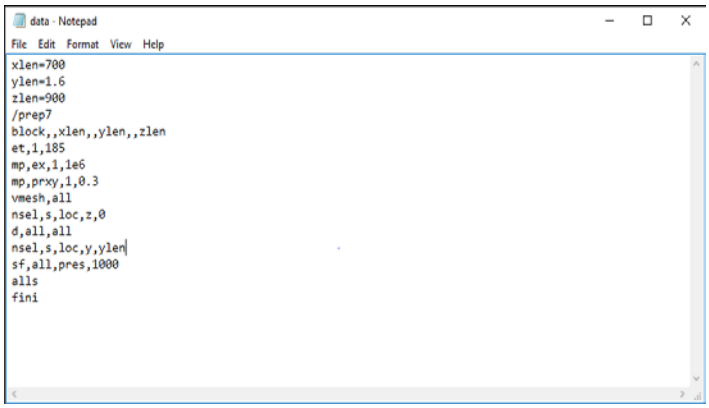


Figure 3.3: TXT command

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Pop up “Read File” appear, open file name “Desktop” at right column and find name file “data.txt”

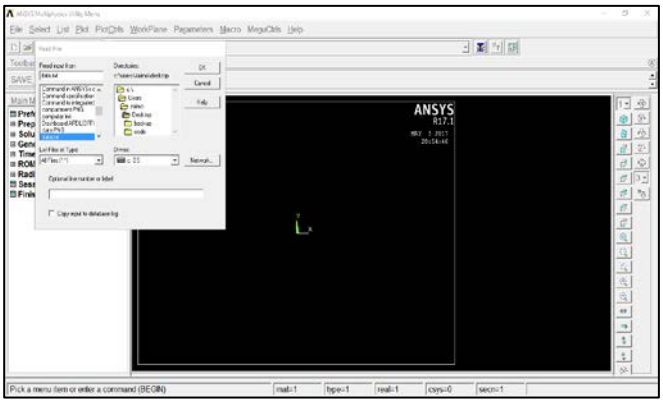

Figure 3.4: GUI APDL setup

Data being generate by clicking “ok”, display of structure adjust at Oblique view part.

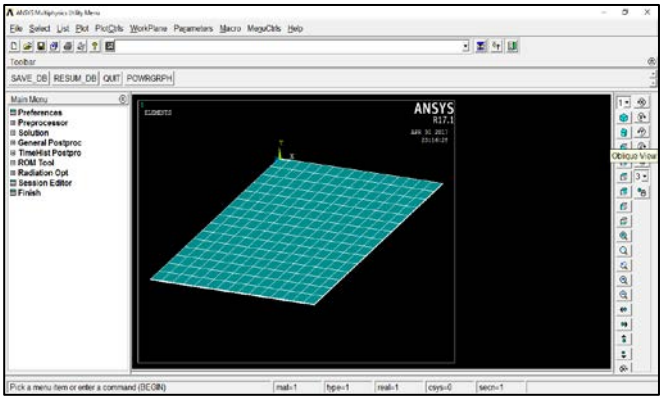

Figure 3.5: APDL generate structure

4 Conclusion

Shown that the structure change as required base on Microsoft Excel GUI, due that this alternative way can minimize time of designing stage and approximate the design requirement.

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