High Efficient and Powerful Integrated Design Support System "DYNA-Works”

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ABSTRACT

Nowadays, the CAE models are getting larger and more complicated. On the other hand, the simulation software including FEM codes, PRE-processors and POST-processors, must be quicker, more accurate and also easy to be used by various level customers. The authors introduce the developing high efficient and powerful design supporting system "DYNA-Works, completely specialized to LS-DYNA." In this system, besides the general pre-post capabilities, the parts can be freely assembled into the simulation model. The response will be very quick even for the huge models. The data between PRE-POST systems and also among multi-stages problems will be connected seamlessly in this system. As a result, the total design cycle will be reduced very much.

INTRODUCTION

In recent years, it has been always required to reduce the design cycle and improve the quality, especially at design and production section in companies. The design cycle is divided into these three stages, the preliminary design, the structure design and the production design. It is regarded that these stages have been clearly separated (Figure 1). So the total period of design cycle has been the simple summation of each stage. To reduce the design cycle in the near future, it is needed that these stages are overlapped each other and each stage improves the design quality.

In this design trend, the computer simulation must be not only the tool to verify the experiment, but also the tool to support the design efficiently, estimate the design contents appropriately and modify them immediately. This idea has been proposed as the concurrent engineering for almost twenty years. By the recent improvement of software, hardware and analysis skills, it is getting to the reality. Nowadays it is said that, the simulation is getting the almost complete alternative of the experiment, and it is getting possible to survey the design parameters immediately enough, and so on.

The next generation of PRE-processors and POST-processors must be the software to satisfy this design trend. In this point of view, the authors introduce a new developing design supporting system "DYNA-Works". The authors regard this product as not only a typical PRE and POST-processor but a high efficient and powerful design supporting system completely specialized to "LS-DYNA". This paper describes the concepts and features of DYNA-Works.

FEATURES

The concepts of DYNA-Works are following.

Seamless Structure between PRE and POST-processor -
In the almost all software, PRE-processor and POST-processor are clearly separated modules or use the different windows. In DYNA-Works, there is no obvious boundary between PRE-processor and POST-processor. DYNA-Works itself is only one module, and uses the common style of windows. This characteristic is especially useful to check whether the data is valid or not. For example, it is much easier to verify and modify the solver input data by the analysis result.

Full Support for "LS-DYNA" -
Generally, when the users operate the PRE/POST-processor, they must learn the input data systems of both solver and PRE/POST-processor. Now a couple of PRE-processors may have the same catch phrase "Full Support", but in fact it is all the same that there are two input data systems in the software. So, many users must consume the comparatively longer time to set the condition data specific to "LS-DYNA", because the

two input data systems are different. DYNA-Works supports full keyword of "LS-DYNA" as the only input data system. That is to say, DYNA-Works has the internal data structure completely corresponding with "LS-DYNA" keyword system. This means that DYNA-Works not only supports all "LS-DYNA" keywords but also handles the FEM data properly according to solver system with no contradiction. This characteristic has another merit that DYNA-Works may easily keep to serve the availability for the customer even if the solver updates frequently or has many new functions.

Assemble FEM Components Freely -
When the users must analyze the FEM model in many cases, they usually need to change the FEM component itself or component's geometry frequently. Now in general PRE/POST-processors, the users must do the laborious work to delete the component from FEM model or change it into another alternative one. In DYNA-Works, it is possible for the users to make the FEM model by assembling FEM components. For example in crash analysis, users can assemble the car using the occupant dummy or tire that are already registered into the database as the components. (Figure 2)

Dialog and Help: Similar Format as User's Manual -
In DYNA-Works, a graphical user interface (GUI) shows the similar dialogs and the input fields for the definitions of parameters to "LS-DYNA" user's manual. (Figure 3) In this figure, the dialog of keyword "*CONTACT" is displayed. A dialog consists of the tabs related to "LS-DYNA" card. The tabs can increase or decrease in the dialog automatically to operate the combo boxes for the option keyword. In each tab, the help messages for the variables are also displayed. These messages are mainly pulled out from the user's manual and implemented here. So the users may have less opportunity to consult the book of user's manual.

Fast Response Even for Huge Model –
The authors regard that the processing speed is one of the most important features to operate PRE/POST-processor. The processing speed means the quick response for painting or animation, and the quick response for any kind of operation. DYNA-Works adopts OpenGL as graphics library compatible with PC and UNIX platform.

Analysis Data Management for Design Project -
The relationship among the projects, analysis input and result files is represented as intuitive tree figure. So the data between PRE-POST systems and also among multi-stages problems in stamping analysis will be connected seamlessly in this characteristic.
So this characteristic can be regarded as the developing form of "JSTAMP-Works" that The Japan Research Institute developed.

OPERATIONS

The overview of DYNA-Works is shown in Figure 4 of the APPENDIX. DYNA-Works adopts the multi views to handle multi FEM models. In this figure, One model view is widely spread to the DYNA-Works window. One model view consists of three sub views, the draw view, the tree view, and the list view. The center-right view is called the draw view. In the draw view, model's shape is displayed in three-dimensional view same as the other PRE/POST-processors. Some of the operations frequently used like shading display, wire mesh display, transparent display, or animation switches are implemented as the button of toolbar. It is also possible to set the display precisely, using the pull down menu and the dialog, and so on.

In addition, the users can set the arbitrary character string in the draw view just like using the drawing software. It may be helpful to make the contents for reports by setting the

character to designated position, font and color. The upper-left view is called the tree view to show the information of “LS-DYNA" keyword included by the model. The tree view displays the keywords in alphabetical order if they exist in model. The tree view consists of four tabs. The first tab displays the keywords that the reference ID’s destinations are completely found. The second tab is for the keywords that the reference ID’s destinations are not found. The third is for the displayed keywords in the draw view. The forth is for the hidden keywords. The lower-left view is called the list view to show the list of “LS-DYNA" cards of the keyword selected in the tree view. For example, if the keyword “*PART” is selected in the tree view, the part data are displayed in the list view identified with the column information as “HEADING”,”PID”, and so on. The selecting operation is available on both the draw view and the list view. And the selecting state of the parts, elements, and nodes are synchronized in these both views. Thus, the users can add, delete, update and copy the condition data to the model comparatively easier.
The general way of operations is according to the typical software in PC platform.

PLATFORM

The authors are planning to serve on both WINDOWS NT4.0 (2000) platform and UNIX platforms of main vendors.

APPENDIX

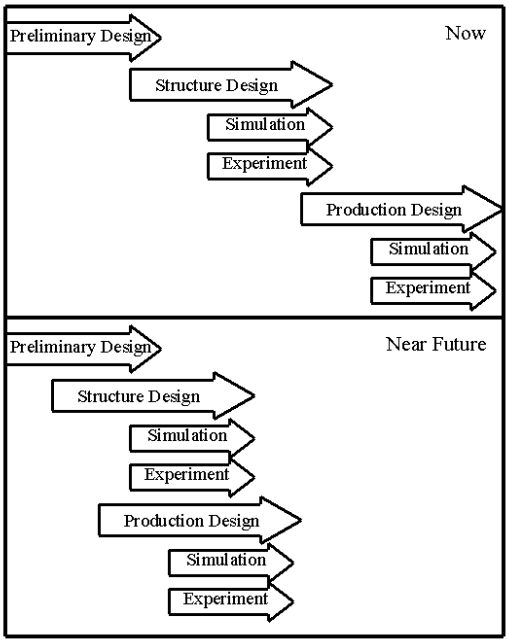

Figure 1. Design cycle

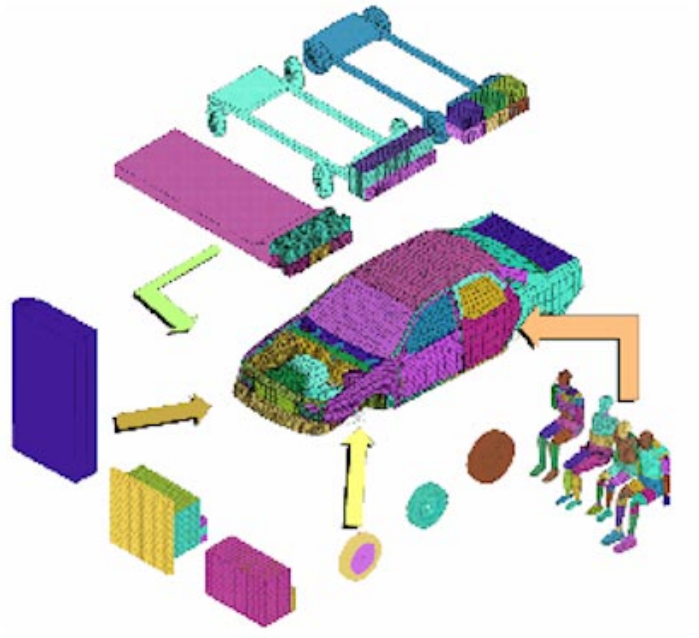

Figure 2. Assemble FEM components into model

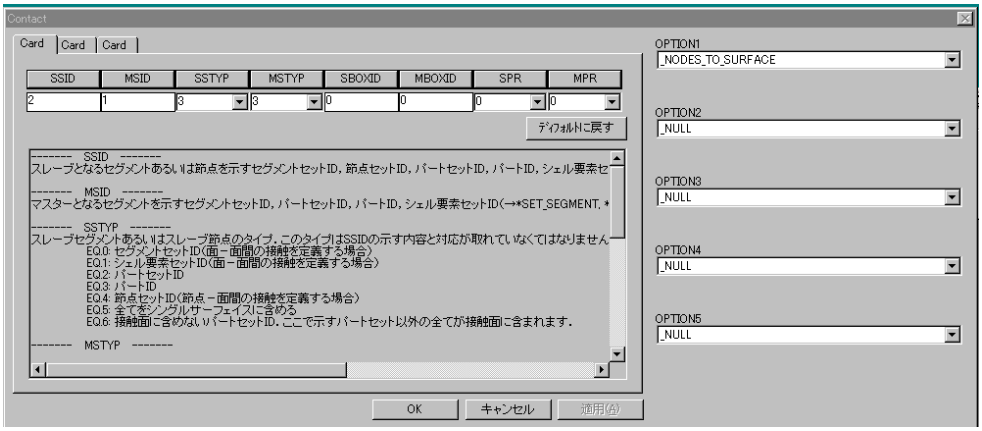

Figure 3. Dialog similar to “LS-DYNA" user’s manual.

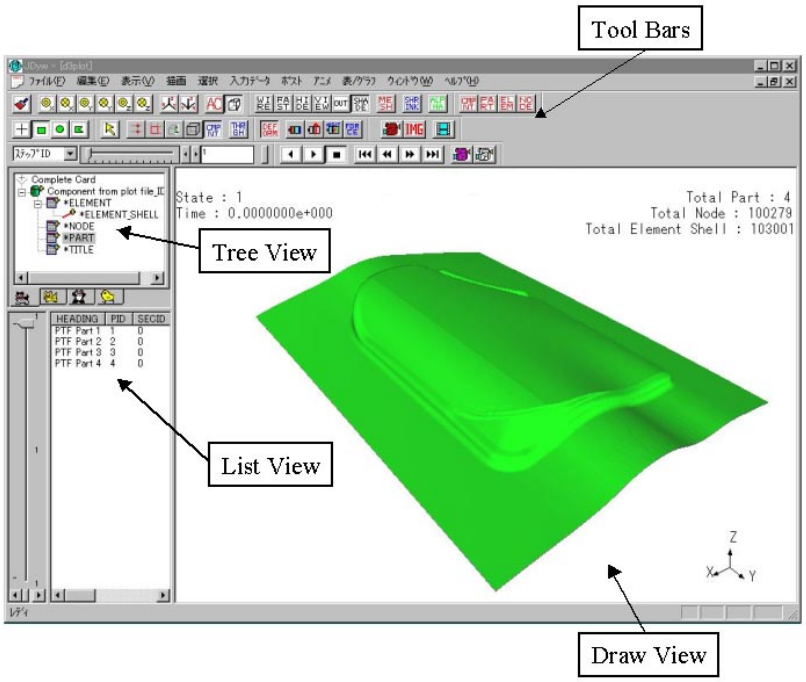

Figure 4. DYNA-Works Overview