Knowledge Based Design Wizard and Analysis MSC.Acumen of Automotive Body By Application Development of MSC and UGS Software

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Abstract

A study on the integration of CAD/CAE, KBE's application on automotive body design and analysis, and body design wizard was carried with the aim of realizing rapid product development. The study was conducted with the emphasis on the following points.

(1) Integration technology of CAD/CAE.

(2) Knowledge rules and application on automotive body design and analysis.

(3) Knowledge database of body design and analysis.

(4) Body design wizard.

(5) Application development of MSC.Nastran and UG/API.

Key Word: Automotive body design and analysis Knowledge-based engineering (KBE) Integration Design process wizard Application development of CAD/CAE

1 INTRODUCTION

Increasing requirement for automotive product rapid development draws recent attention to knowledge-based engineering and application on automotive body design and analysis. Because quality of development of vehicle will be good ,and speed of development will also be rapid, if development process wizard, knowledge database and rules are applied on body design and analysis. Integration of KBE and CAD/CAE/CAM is very important for rapid product development. Application or customizing development of CAD/CAE/CAM software will shorten the time , advance the quality, and save much money of development of automotive product.

2 OUTLINE OF BODY DESIGN WIZARD

- Step by step guide to design tasks
- Migrate corporate knowledge from people and paper into accessible and reusable electronic form
- Important corporate assets preserved
- Reduce errors and effort expended on repetitive tasks

So the wizard is the best method to provide user the maximum flexibility and convenience to design an automotive body.

2. 1 Components of Body Design Wizard

The wizard should include the following functions:

- Body Design Wizard
- Body Analysis MSC.Acumen
- Body Formability MSC.Acumen
- Body Design Knowledge rules
- Body Design Knowledge Database

2.2 Program Flow Diagram

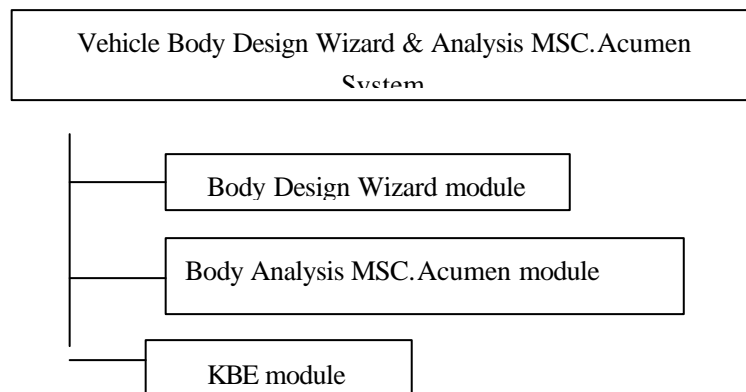The flow diagram of Body Design Wizard are shown as Figure 1~4.

Vehicle Body Design Wizard & Analysis MSC.Acumen System

Body Design Wizard module

Body Analysis MSC.Acumen module

KBE module

Figure 1 Program Flow Diagram

Body Design Wizard

Preprocess

⇧

KBE Rules
Database

Initial Body Generation Wizard

Body Partitioning Wizard

Detailed Design

⇧

KBE Rules
WAVE
UDF
Vehicle Feature

Component

External

Front wall Design Wizard

Side wall Design Wizard

Rear wall Design Wizard

Roof Design Wizard

Floor Design Wizard

Internal

Console Design Wizard

Control Design Wizard

Seal Design Wizard

Body package Wizard

Postprocess

⇧

KBE Rules
Database

2D Drafting Generation Wizard

Section Drafting Generation Wizard

File Management Wizard

Additional

Math Process Wizard

Vehicle Feature Generation Wizard

Figure 2 Body Design Wizard

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┌─────────────────────────────┐
│ Body    Analysis   MSC.Acumen│
└─────────────────────────────┘
    │                                    ┌──────────────────────────┐
    │        ┌──────────────────────────┐│      Scenario(UG)        │
    ├────────│Finite Element Analysis   │└──────────────────────────┘
    │        │        Acumen            │┌──────────────────────────┐
    │        └──────────────────────────┘│ MSC.Patran & MSC.Nastran │
    │                                    └──────────────────────────┘
    │        ┌──────────────────────────┐┌──────────────────────────┐
    ├────────│Air-Dynamics Analysis     ││    MSC.CFD Module        │
    │        │      MSC.Acumen          │└──────────────────────────┘
    │        └──────────────────────────┘

    │        ┌──────────────────────────┐┌──────────────────────────┐
    └────────│Body    Structure         ││      MSC.Patran          │
             │  Formability             │└──────────────────────────┘
             │Analysis  MSC.Acumen      │┌──────────────────────────┐
             └──────────────────────────┘│      MSC.Nastran         │
                                         └──────────────────────────┘
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Figure 3 Body Analysis Acumen

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┌─────────────────────────────┐
│ Body Design KBE Module      │
│                             │
└─────────────────────────────┘

        │       ┌──────────────────────────┐
        │       │    ISO/SAE standard      │
        │       └──────────────────────────┘
        │       ┌──────────────────────────┐
        │       │Vehicle Analysis and Body │
        ├───────│      Design KBE Rule     │
        │       └──────────────────────────┘
        │       ┌──────────────────────────┐
        ├───────│Section Database and KBE Rule│
        │       └──────────────────────────┘
        │       ┌──────────────────────────┐
        └───────│      Seal Database       │
                └──────────────────────────┘
        ┌───────┌──────────────────────────┐
        └───────│    Analysis Database     │
                └──────────────────────────┘
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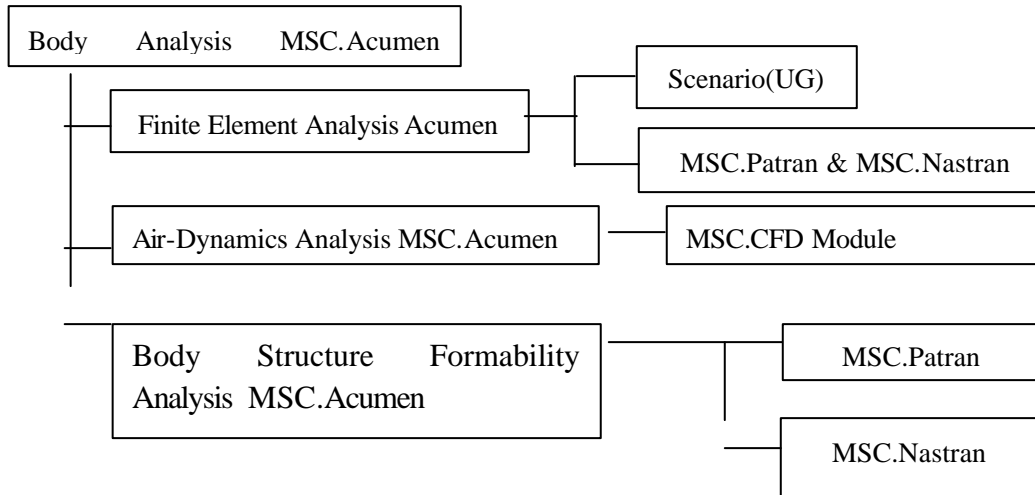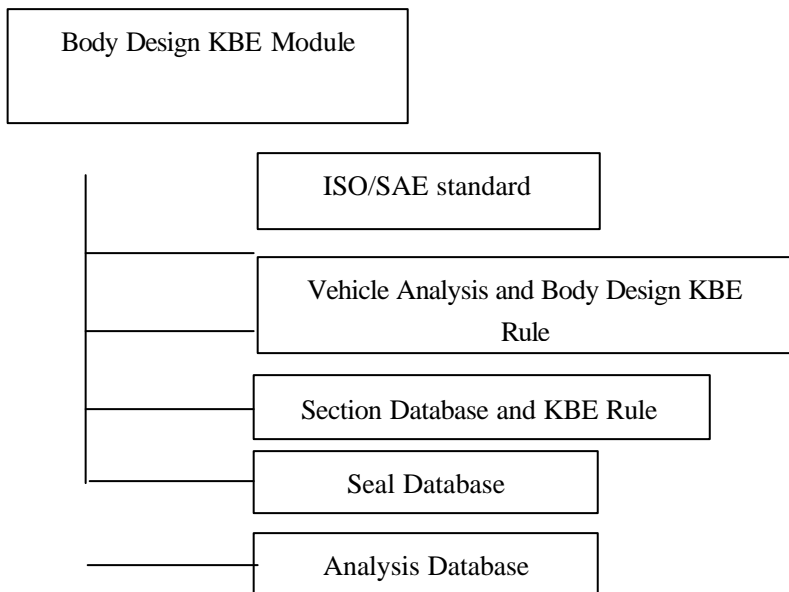
Figure 4 Body Design KB

3. FUNCTIONAL DESCRIPTION OF BODY DESIGN WIZARD & ANALYSIS ACUMEN

Body Design Wizard is a Wizard system step by step to guide users to generate associative assemblies of Vehicle body, by support of WAVE, Database, KBE rules, math advancement etc.. The associative assemblies can make other parts automatically do relevant modifications when parameters of one part or several parts in assemblies is modified, thus designers can reduce errors and efforts

expended on repetitive tasks.

Body Design Wizard includes the following items:

- Initial Body Generation
- Body Partitioning
- Front Wall Design
- Side Wall Design
- Rear Wall Design
- Roof Design
- Door Design
- Console Design
- Control Parts Design
- Seal Design
- Body Package Design
- 2D Drafting Generation
- Sections Drafting Generation
- Database Management
- Math Process
- Vehicle Feature Generation
- Geometric Analysis
- Finite Element Analysis
- Computer Flow Dynamics Analysis
- ISO/SAE Standard Database
- Vehicle Style Database
- Section and Section Rules Database
- Seal Database
- Body Design & Analysis KBE Rules Database

4 INTERFACE AND SOME EXAMPLE OF RESEARCH RESULT

- Body Design Wizard is invoked from Application→ Body Design Wizard→….
- Body Analysis MSC.Acumen By Development of MSC.Software Corporation
- Body Analysis MSC.Acumen/
  Geometric Analysis Wizard is
  invoked from Body Analysis
  MSC.Acumen → Geometric Analysis
- Body Analysis MSC.Acumen /Finite Element Analysis Wizard is invoked from Body Analysis MSC.Acumen → Finite Element Analysis
- Body Analysis MSC.Acumen / Body Structure Formability Analysis Wizard is invoked from Body Analysis MSC.Acumen → Body Structure Formability Analysis
- Body Analysis MSC.Acumen / Air-Dynamics Analysis Wizard is invoked

from Body Analysis MSC.Acumen → Air-Dynamics Analysis

- Body Design KBE/ISO/SAE Standard Database is invoked from Body Design KBE →ISO/SAE Standard
- Body Design KBE /Vehicle Analysis and Design Database is invoked from Body Design KBE → Vehicle Analysis and Design
- Body Design KBE /Section Parameters and Knowledge Database is invoked from Body Design KBE → Section Design
- Body Design KBE /Seal Database is invoked from Body Design KBE → Seal
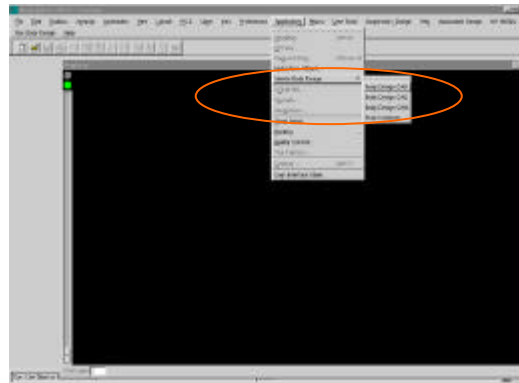
The some interface of Body Design Wizard are shown as Figure 5~7.
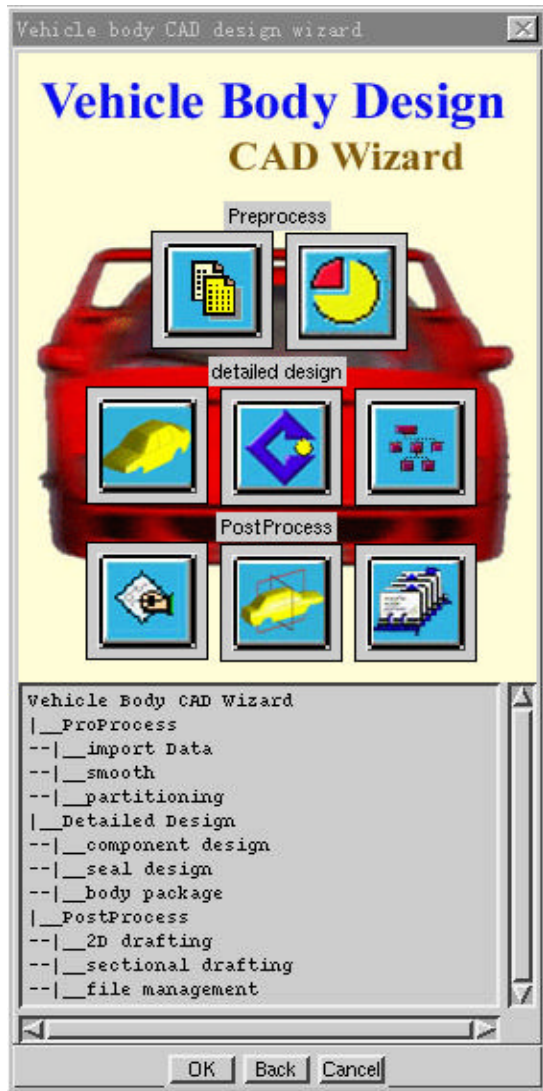

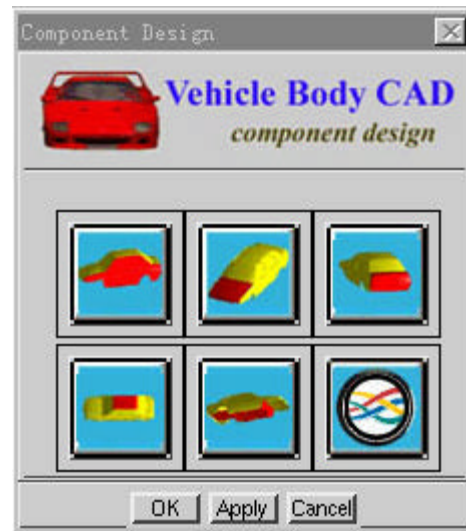Fig 5 Interface In CAD/CAE

Fig 6 Body Design Wizard

Figure 7 Body Components Design Wizard

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