

Expanding and Utilizing JMAG-Bus for Developing Motor Systems

Takehiro Miyoshi

Technology Research Division 9, Automobile R&D Center, Honda R&D Co.,Ltd.

Abstract :

CAE analysis is an effective tool for both shortening the development period and improving the quality of motors, but in recent years a considerable amount of skill and man-hours have become necessary for the analysis itself due to the increasing complexity of systems. the current situation is that sufficient time cannot be given to traditional design consideration.

We used JMAG-Bus, and by simplifying data input and output and constructing a analysis system that standardized everything up to data management, we were able to shorten the total time for analysis and improve development efficiency.

Today I would like to introduce this system and provide case examples of application.

Confidential

HONDA
The Power of Dreams

1

Expanding and Utilizing JMAG-Bus for Developing Motor Systems

Honda R & D Co., Ltd.
Automobile R&D Center
Technology Research Division 9
Takehiro Miyosh

Company profile of Honda Motor Co., Ltd.

Confidential

HONDA
The Power of Dreams

2

Joining People in Searching for Dreams
and Making Them a Reality



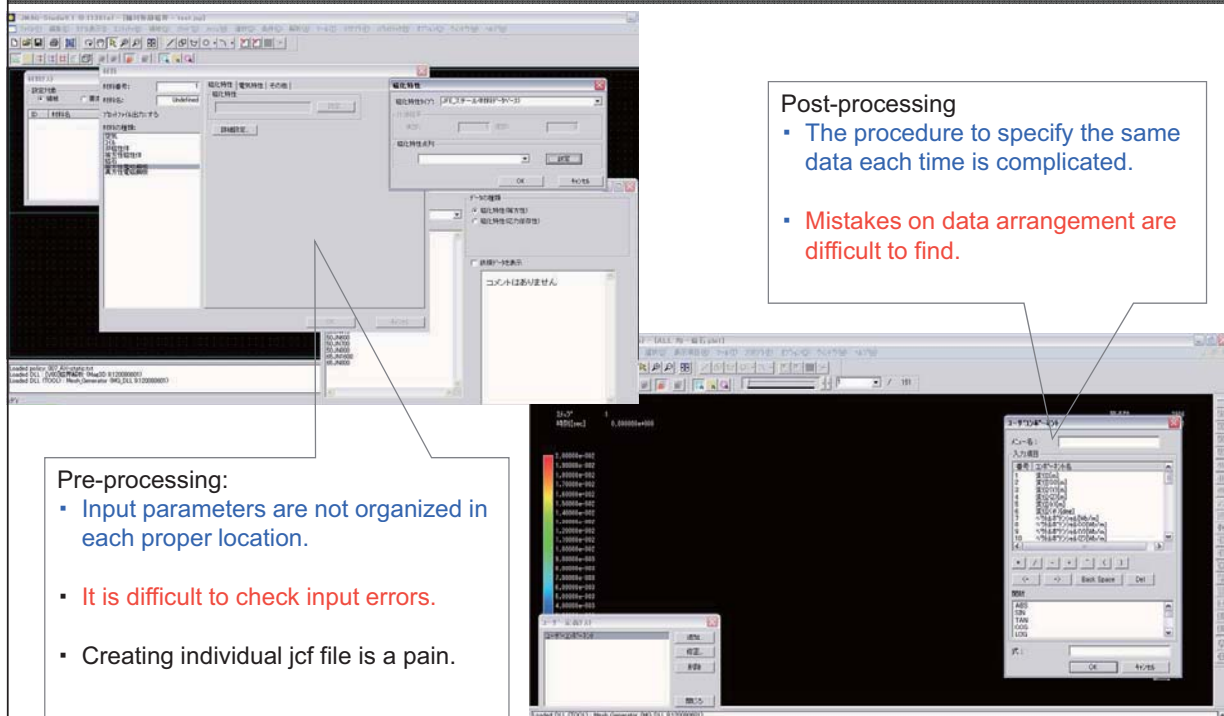
We at Honda cherish the dreams and ideas that people have when they imagine what would bring enjoyment to their own lives or happiness to the lives of others, and therefore strive every day to develop new products and technology.

The dream that we share gives us the courage and strength to work toward making it a reality without fearing failure. Our dreams give us the power to move forward.

"The Power of Dreams" motivates Honda to come up with new ideas for bringing joy to the world.

Motor Development for Mass Production Hybrid Vehicles (Points need to be improved with JMAG)

Points need to be improved with JMAG-Studio



Pre-processing:

- Input parameters are not organized in each proper location.
- It is difficult to check input errors.
- Creating individual jcf file is a pain.

Post-processing

- The procedure to specify the same data each time is complicated.
- Mistakes on data arrangement are difficult to find.

JMAG-Studio's various functions is awkward to use for some small consideration.

Add-up: Points need to be improved with JMAG-Studio

Confidential

HONDA
The Power of Dreams

5

| Items | | Problems | Man-hours |
|------------------------|--|--|-----------|
| Preparations | Streamlining the analysis environments | Upgrading versions on each computer is troublesome. | |
| | CAE operations | Man-hours for learning the operations is required. | |
| Pre-processing | Creating models | Man-hours for learning the operations is required. | |
| | Inputting conditions | Many parameter inputting are complicated even for small parameter studies. | ● |
| Analysis | Running analyses | Data managements are difficult when running multiple analyses. | ○ |
| Post-processing | Coordinating analysis results | Procedures of extracting and coordinating the data are complicated. | ● |
| | Verifying analysis results | It is difficult to verifying the result after completing analysis. | ○ |
| Horizontal development | Sharing the data | It is difficult to share the data because each individual keeps data. | ○ |
| | Inheriting know-hows | It is difficult to inherit analysis ingenuities. | ○ |

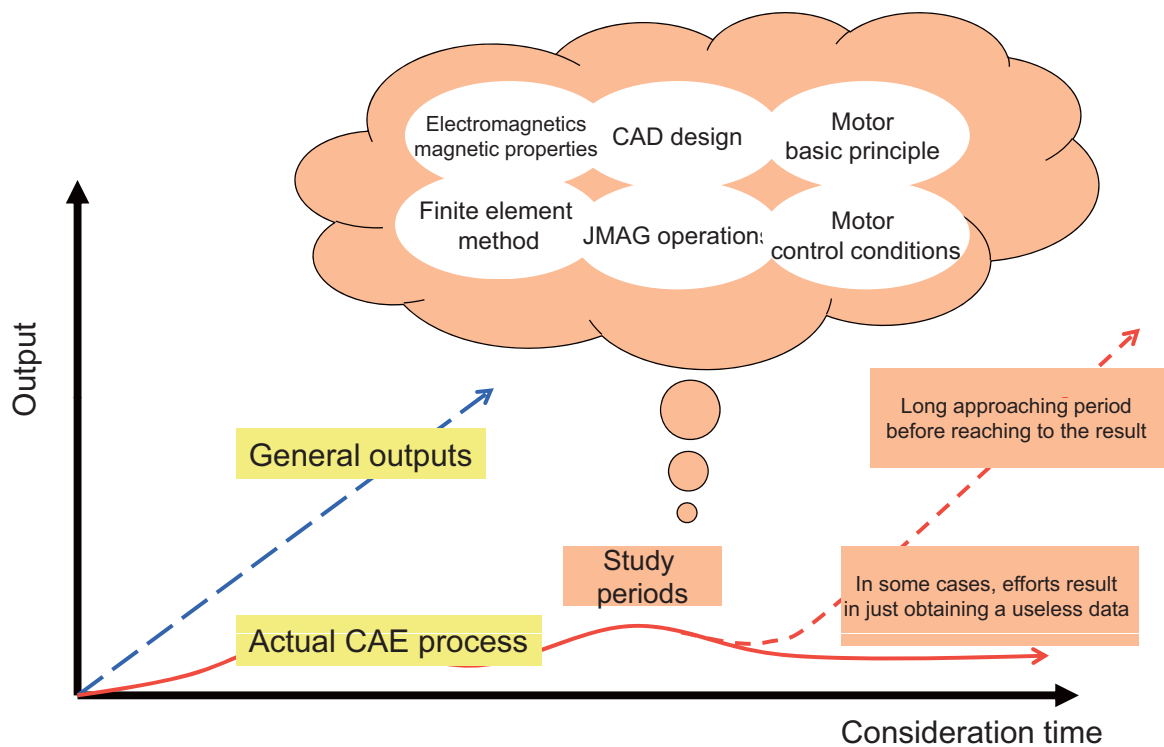
●: Large ○:Middle

Un-user-friendliness of CAE

Confidential

HONDA
The Power of Dreams

6



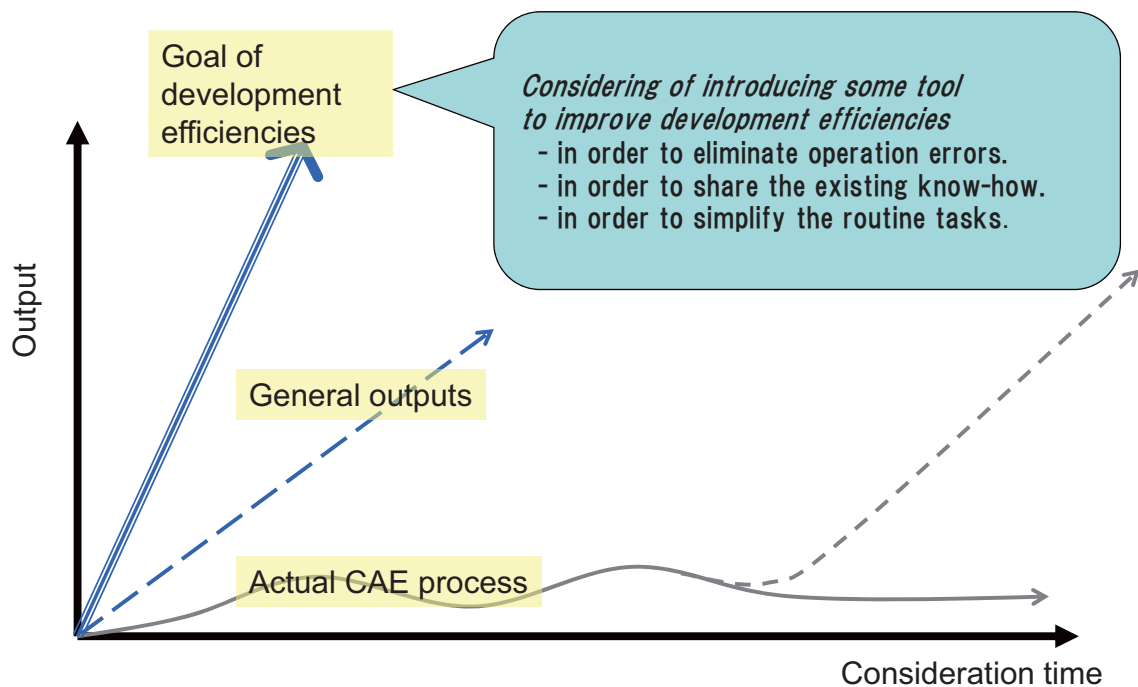
CAE users encounter lots of difficulties before obtaining a result.

Improvement methods for development efficiencies

Confidential

HONDA
The Power of Dreams

7



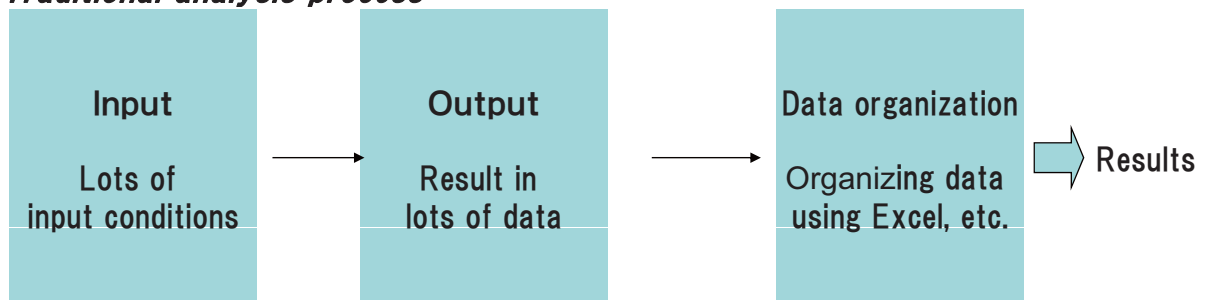
Searching for developing a CAE tool that achieves a satisfactory level of performance in a short period of time

Improvement methods for development efficiencies

Confidential

HONDA
The Power of Dreams

8

Traditional analysis process**New analysis process**

Standardizing the whole analysis procedures including the data organization
= Efficient utilization of the built-up know-how is necessary.

Standardize the items other than the examination items to improve the development efficiencies.

JMAG—BUS Overview

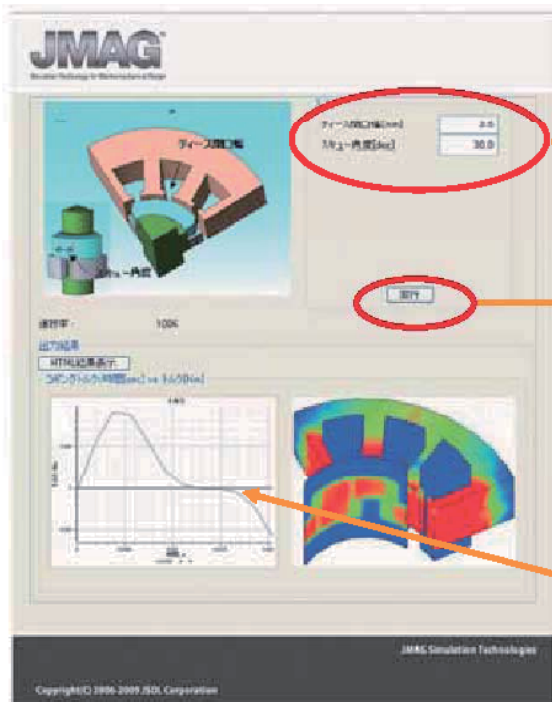
- Be able to customize the versatile JMAG interface to the one that directly links to your task.
- Just inputting necessary parameters on the browser enables you to obtain your desire analysis results such as contour figures or graphs.
- Analysis know-how is not required, so even analysis beginners or users who carry out analysis infrequently will be able to conduct simulations successfully.
- List display enables you to share the analysis results easily.

JMAG—BUS Overview

Confidential

HONDA
The Power of Dreams

11



Only the design values to be evaluated appear on the screen.

Click the "Execute" button to perform an evaluation.



CAE software executes "model creation", "analysis", and "result evaluation" in background.

Users can concentrate entirely on his operation without regard of complicated CAE soft's screen operations.

Only the observation values to be evaluated appear on the screen.

JMAG—BUS Overview

Confidential

HONDA
The Power of Dreams

12

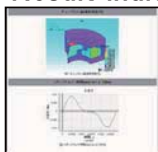
Parameter input



Web browser



Result indication



Web browser

Web browser

- JMAG
- Third-party programs (Software that can be controlled from outside)

JMAG-Designer&Bus

JMAG is web-based, and it allows users to use it on a computer that JMAG is not installed.

Inputting parameters

Confidential **HONDA**
The Power of Dreams

JMAG
Simulation Technology for Electromechanical Design

Ver3.1.8.18

S2 モーター1 (IPM, N-T特性, 効率特性)

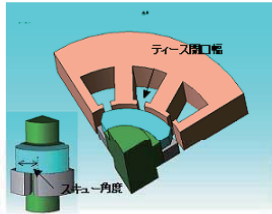
フォルダ名
 ユーザ名
 プロジェクト名 ケース名
 完了日時 計算時間

レポート表示

 名前をつけて保存

STAGE1: [入力]

1 ティース開口幅[mm]
 2 スキュー角度[deg]
 3
 4
 5



備考がある場合はここにメッセージを記載します
備考がある場合はここにメッセージを記載します

Just inputting necessary parameters on the browser

Running analysis

Confidential **HONDA**
The Power of Dreams

JMAG
Simulation Technology for Electromechanical Design

Ver3.1.8.18

S2 モーター1 (IPM, N-T特性, 効率特性)

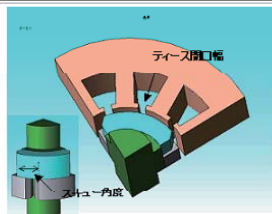
フォルダ名
 ユーザ名
 プロジェクト名 ケース名
 完了日時 計算時間

レポート表示

 名前をつけて保存

STAGE1: [入力]

1 ティース開口幅[mm]
 2 スキュー角度[deg]
 3
 4
 5

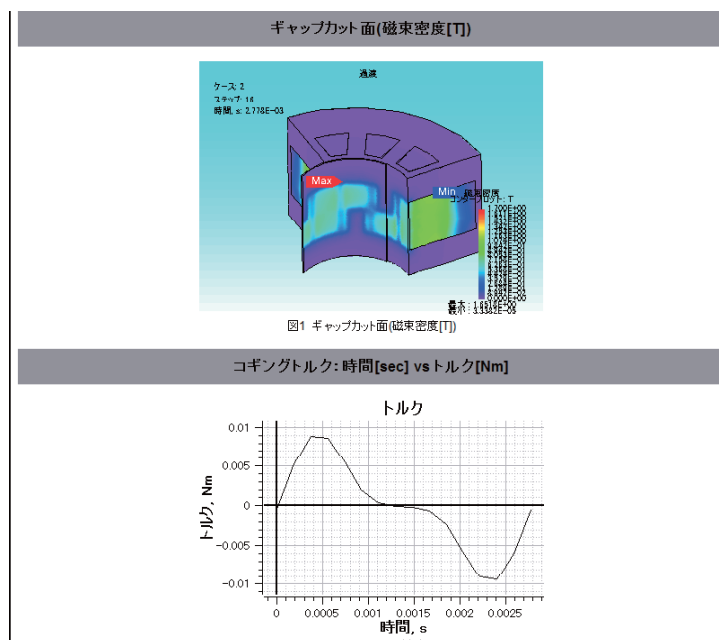


実行

Analysis know-how is not required, so even analysis beginners or users who carry out analysis infrequently will be able to conduct simulations successfully.

Evaluating results

Confidential

HONDA
The Power of Dreams

Be able to obtain your desire analysis results such as contour figures or graphs.

Managing the analysis data

Confidential

HONDA
The Power of Dreams

JMAG[®] Simulation Technology for Electromechanical Design

S2 モーター1 (IPM, N-T特性, 効率特性)

新規解析 一覧更新 ケース追加

record count: 8
total size: 676.47 [MB]

| No. | フォルダ名 | ユーザ名 | プロジェクト名 | ケース名 | ギャップ開口幅 [mm] | スキュー角度 [deg] | 力 | 速度 | size [MB] | Stage:1 | |
|-----|-----------------------------------|------|---------|--------|--------------|--------------|--------|--------|-----------|---------|----------------|
| - | | | | | | | 検索 | - | - | - | |
| 1 | 20111108223701270 | jmag | test | test01 | 2.0 | 15.0 | 選択 | 0.57 | RUN | | 全て削除 plot削除 |
| 2 | 20111108214553374 | jmag | b | b | 1.5 | 30.0 | 5.0 選択 | 160.14 | End | | 全て削除 plot削除 |
| 3 | 20100909193914623 | jmag | xx | xx | 1.5 | 30.0 | 5.0 選択 | 128.94 | End | | |
| 4 | 20100909193747434 | jmag | b | b | 1.5 | 30.0 | 5.0 選択 | 128.94 | End | | |
| 5 | 20100909191333437 | jmag | aa | aa | 1.5 | 30.0 | 5.0 選択 | 128.94 | End | | |
| 6 | 20100909184946873 | jmag | a | a | 1.5 | 30.0 | 5.0 選択 | 128.94 | End | | |

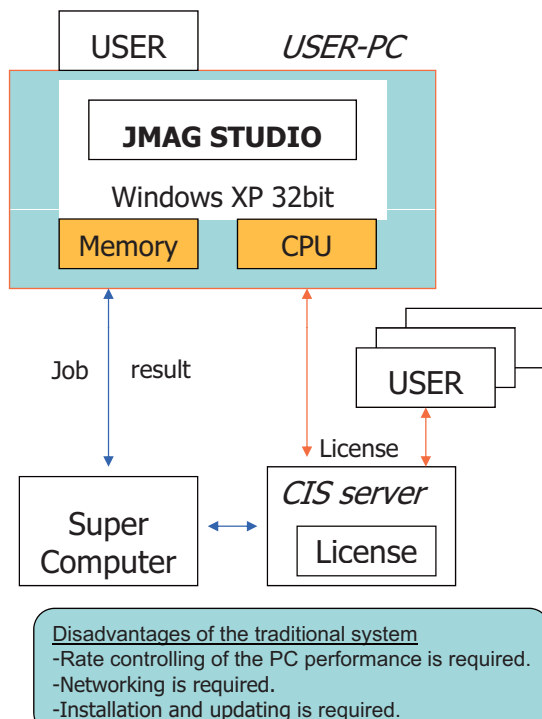
TOP

List display enables you to share the analysis results easily.

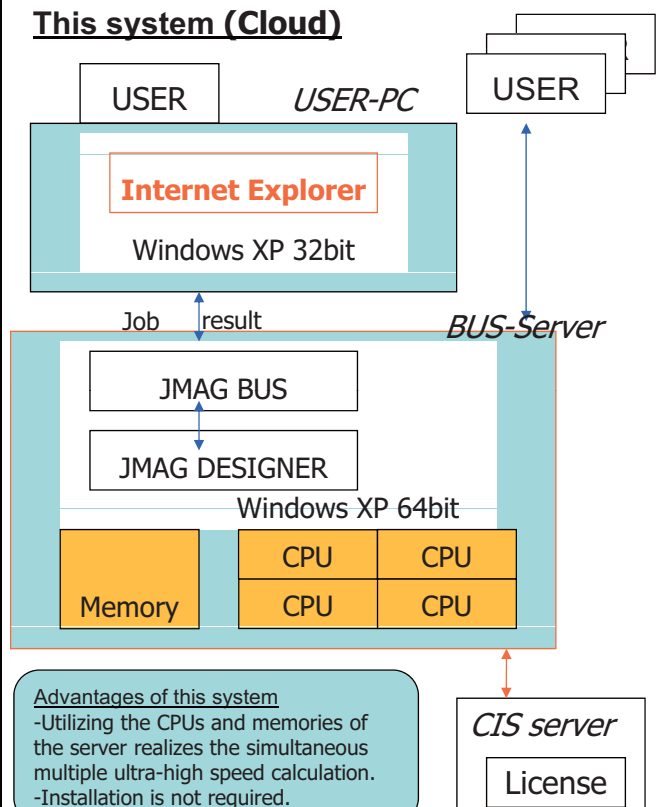
Implementing JMAG-BUS and the advantages it brings

Introduction case of JMAG-BUS

Traditional system (Stand alone)



This system (Cloud)



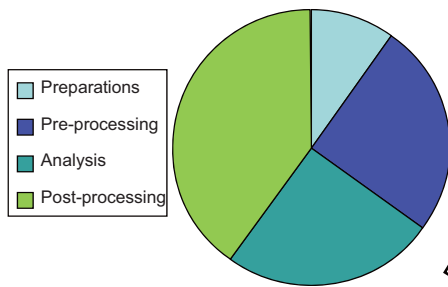
Advantages JMAG brought

Confidential

HONDA
The Power of Dreams

19

Analysis example using JMAG-Studio



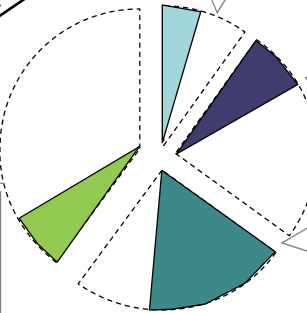
Preparation:
Updating the software
is not required
No operation manual is
necessary.

Other advantages:
More analysis
members can be
involved
Easy data sharing
Simple maintenance
(HDD and others)

Analysis example using JMAG-BUS

2 people x 2 weeks
⇒ 1 person (fresh recruit) x 3 days

Post-processing:
Minimizing the data
organization time
Eliminating human errors



Pre-processing:
Minimum numeral
inputting is required.
No necessity of
creating jcf files

Analysis:
Batch analysis on the
server
No load to client PCs

JMAG-BUS shortened the entire study time to 1/3 of the previous performance.

Conclusion of the advantages

Confidential

HONDA
The Power of Dreams

20

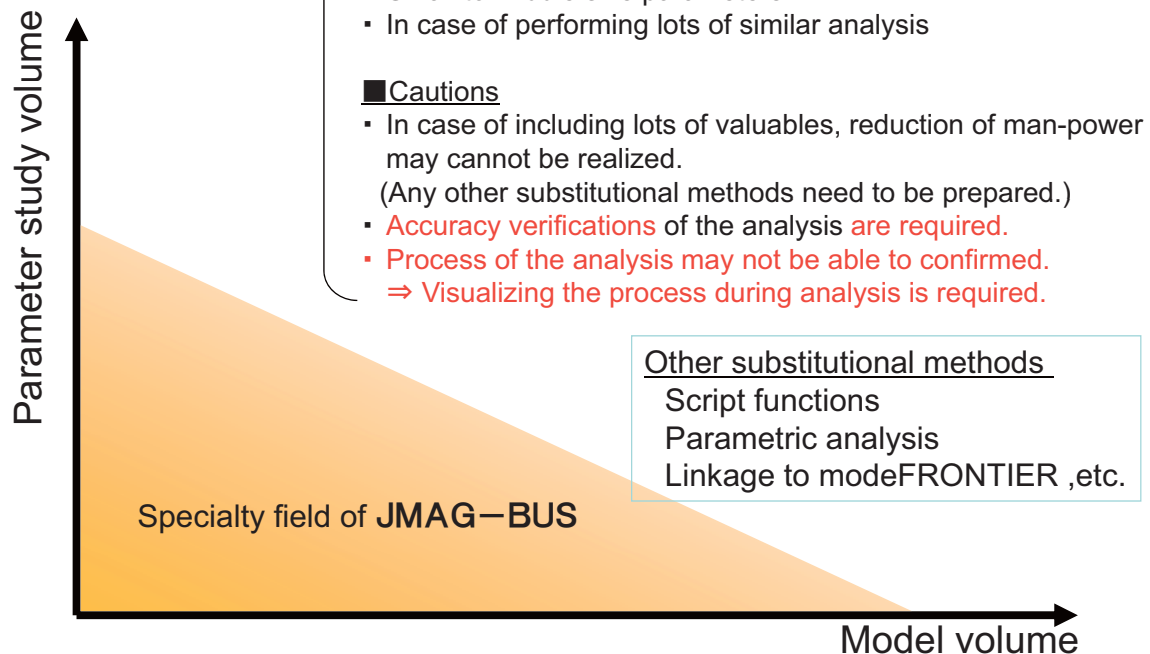
| Items | | Problems | After implementing JMAG-Bus |
|------------------------|--|---|-------------------------------------|
| Preparations | Streamlining the analysis environments | Upgrading versions on each computer is troublesome. | Management on only one computer |
| | CAE operations | Man-hours for learning the operations is required. | Simple inputting |
| Pre-processing | Creating models | Man-hours for learning the operations is required. | Models can be created all together. |
| | Inputting conditions | Many parameter inputtings are complicated even for small parameter studies. | Simple inputting |
| Analysis | Running analyses | Data managements are difficult when running multiple analyses. | Simple inputting |
| Post-processing | Coordinating analysis results | Procedures of extracting and coordinating the data are complicated. | Simple inputting |
| | Verifying analysis results | It is difficult to verifying the result after completing analysis. | Be able to easily check on the list |
| Horizontal development | Sharing the data | It is difficult to share the data because each individual keeps data. | Be able to easily check on the web |
| | Inheriting know-hows | It is difficult to inherit analysis ingenuities. | Be able to easily share models |

Cautions concerning JMAG-BUS

Confidential

HONDA
The Power of Dreams

21



Flexible usage is required because JMAG-BUS is not a universal tool.

Conclusion

Confidential

HONDA
The Power of Dreams

- Minimizing the inputs and outputs using JMAG-Bus realized the reduction in working hours of analysis.
- We succeeded in reducing the man-hours for educations, and it result in introducing JMAG-Bus to more users because installing the software is not necessary for this system.
- We are now able to creatively use JMAG-Bus for magnetic analysis and JMAG-Designer for more detail studies and considerations.
- We aim to increase the JMAG-Bus scenarios appropriate to each development themes for the future.