A SIMULATION SOFTWARE DEVELOPMENT WORKBENCH TO DYNAMICS SYSTEM
仿真软件开发工作台

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ABSTRACT: In the paper , We discuss characteristic, structure and application of simulation software development workbench for dynamics systems on the computer -- a new tool software. This workbench is mainly composed of four parts. 1) initial information management part, 2) three library structures, 3) model design tool , 4) running table.

1. INTRODUCTION

It is a important computer application field that dynamic system is simulated on the computer. In the dynamic simulation system, user may do all kinds of tests and analyses for real dynamic systems. Valuable study is done in system dynamics field by many scholars. But programming language is used mostly to develop system dynamics models. There are following weak points by using programming language to develop system dynamics models:

- system development cycle is longer
- the design of the program is in difficulty
- the adjustment and test of the models is in difficulty
- the mistake emerge easily
- no easy to learn

In order to solve these problems, we develop a simulation software development workbench to dynamics system.

"good tools more than dexterousness" . In the development process of simulation software, the progress is made from

application of programming language to application of the tools. However, the new progress is made by using simulation software development workbench. In this paper, we discussed a simulation software development workbench used in programming, test and maintenance on the computer. This workbench is immediately directed at the users and at the application problems. A good environment quickly and efficiently to develop simulation systems is made by the workbench.

2. THE CHARACTERISTICS OF THE WORKBENCH

The characteristics of the simulation software development workbench is followed below:

a) The simulation software development workbench have the characteristics of fourth generation programming method. This workbench is faced to application problems and to users. It is easy to understand and easy to use.

b) The method of developing dynamic system simulation model is changed into the method of the mechanization or is changed into the method of the automation.

c) There are many usefull software development tools and the intergrated module that have very strong function and excellent use interface in the workbench.

d) Many users may parallel develop simulation software by means of the workbench.

e) Developing software cycle is short and the error is a little.

f) The software maintenance is simple.

g) The users develop simulation software at module level rather than using programming language.

h) This workbench may be used by every department or every profession. It is in conmon use throughout the dynamics system.

i) In order to use easily, some rule in the workbench is same as in dynamo language.

3. THE ARCHITECTURE OF THE WORKBENCH

The architecture of simulation software development workbench is mainly composed of four parts, i.e. initial information management part, three library structure, model design tool, running table. There are also some submodule in the very part. The workbench architecture is shown in figure 1.

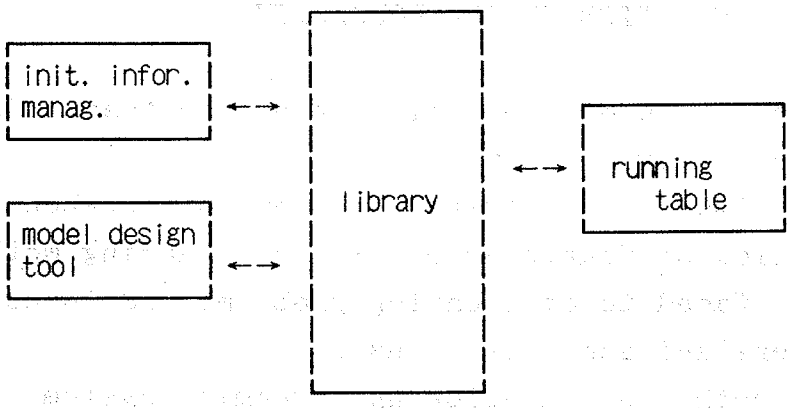

FIG. 1 the architecture of workbench

3.1 inital information management

The inital information management part of simulation software development workbench is shown in figure 2. It is consist of initial data definition module, data input management module and data storage management module.

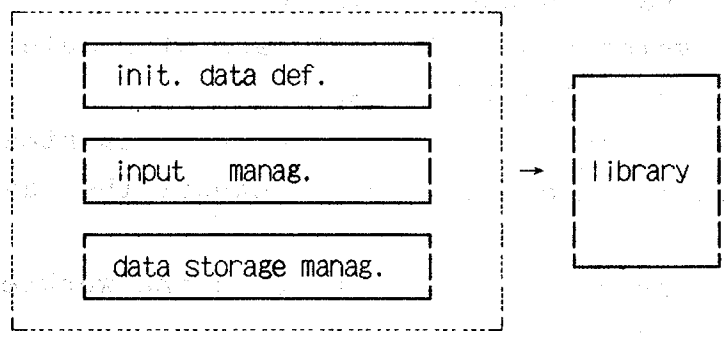

FIG. 2 inital information management part

3.1.1 initial data definition module

The initial data definition module translate the input schema and storage schema written in the defined language on the full screen to object codes and form variable file, constant file, table function file and standard drive function file in the sample data library. The object codes are loaded into the sample data library in order to use them during the operation stage and defined language copy is preserved in order to modify storage schema and screen display schema. The grammar of the defined language is defined as following:

<defined language>::=<item name><display field><receive field>

<item name>::=<chinese character> | <character>

<display field>::=<boundary mark1><character><boundary mark2>

<receive field>::= C | D | A

defined file structure have five types as folowing:

a) state variable file form

number	state var. name	initial value	note

b) rate variable file form

number	rate var. name	initial value	note

c) assistant variable file form

number	assis. var. name	initial value	note

d) constant file form

no.	level no.	con. name	exp.	init. val.	note

e) table function

table name	number	X value	Y value	note

3.1.2 data input management module

The data input manegement module interprete the user statement to complete the operation about the data input by means of the

menu on the full screen. The data input statement is as follows: creat data, add data, modify data, insert data, delete data and so on.

3.1.3 data storage management module

The input data is compressed and is stored into sample library by means of data storage management module. If necessary, we may also store a copy of the input data in the internal storage. Thus, it is advantageous to increase simulation speed. When input data is stored, data sorting is done and the difference mark of user data is built.

3.2 three library structures

The data library is a information center of simulation system development workbench. It is composed of three library, i.e. sample library, work library and result library as shown in figure 3.

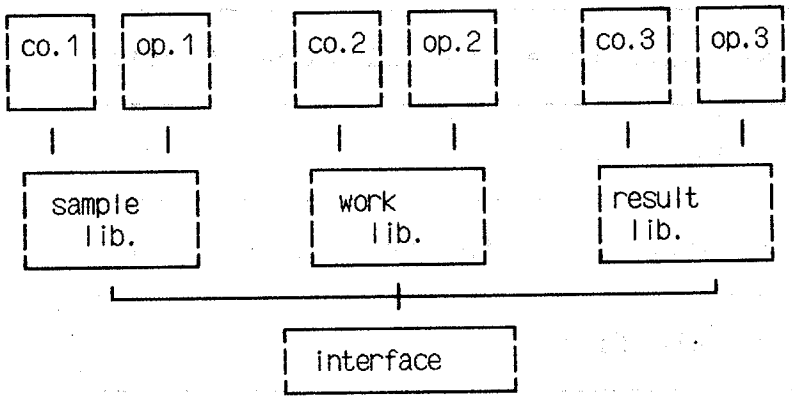

FIG. 3 the data library structure

3.2.1 the sample library

The original data needed by simulation system are storage in the sample library. The sample data sublibrary separated may be made by every users in the sample library. The sample data sublibrary are data files. The some operation, such as sort, smooth, may be done on the data of the sample library by every users.

3.2.2 the work library

The work library have two function. First function is storage simulation model body and interface information. Other function

is storage middle data produced after running simulation system software.

3.2.3 the result libaray

Last data produced by running simulation system is storaged in the result library. There is a backward channel between the result library and the sample library. The data after simulation may become a new sample data.

3.3 the model design tool

The simulation model design tool is nucleus of the computer simulation software development workbench. The user design model body by means of the model design tool. The simulation model design tool is composed of three parts, including input interface module, output interface module and model body design tool.

3.3.1 input interface module

The input interface module complete following tasks. a) link variable file, constant file, table function file and standard drive function file in the sample data library. b) form the name table of the record. c) form display screen of the record content. d) form operation menu.

3.3.2 output interface module

The output interface module complete following tasks. a) link work library to result library. b) send variable value of work library to result library. c) form variable name table. d)form form display screen and menu of the variable.

3.3.3 model body design tool

In the simulation model design tool, the model body design is a important step. The work process of the model body design is described as following:

a) Type the model file name. If the file name is a new file name , then , execute model body design module. If the file name is a old file name, then, execute model body modification model and the old model is displayed in the screen.

b) The option menu is displayed.

c) The state variable name, rate variable name and assistant variable name is prompted in the screen.

d) According to the option menu and the design rule, the

model body is written in the model body design screen.

e) The model interpreter scan the model language to check word and syntex. If errors are not found, the constant name table will be formed.

f) The initial value is imported.

3.4 the running table

The running table is composed of three parts, including the result description design tool, running parameter definition tool and drive function definition tool.

3.4.1 the result description design tool

The result of the computer simulatiom must be given out by the way of convention. The conventional method include table, chart and report.

3.4.2 the running parameter definition tool

Before the simulation model run, following parameter must be defined. a) computing time internal. b) stoping time.

3.4.3 drive function generator

The standard drive function generator is a important test data source of the dynamic system simulation models. The standard drive function include RND function, pulse function, step function, obliqine function and so on.

4. CONCLUSION

According to special feature of system dynamics, this paper discuss characteristic, structure and application of simulation software development workbench. A high level will be reached in the dynamic model by the workbench. At fact, the simulation software development workbench is a powerful tool for developing dynamic system simulation models.

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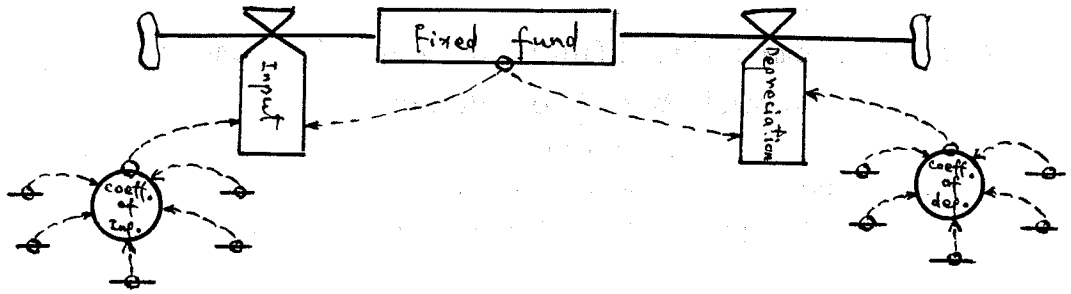

fig. 6 submodel of fixed fund

The development method of model is similar to the above mentioned process. It is not repeated here.

5. NOTICE

5.1 Special limitation of the workbench. The workbench is limited to be used by fewer than ten users at same time. The submodel of one user are not allowed to exceed 8. Otherwise, two users are regarded.

5.2 Stipulation on grammar of design model. To design model means that the users design the state equation, decision equation and auxiliary equation on the screen. The written form is basically similar to the stipulation of DYNAMO language. But symbols are not represented by mark equation.

5.3 Operating order of the workbench. User must strictly abide by the operating order of the workbench, otherwise, mistakes will occur. This is because some operation of the workbench produces the information of the next operation which appears automatically from the system. If the operating order is wrong, the information will not emerge.

6. CONCLUDING REMARKS

This paper expound how to design system dynamics model with the workbench. This is a kind of new design method and new trial. There might be a lot of imperfection which is open to the advice and comments of the experts and scholars.

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