A Design Method of Damage Effect Basic Management Model

Yong Sun, Hongfu Wang, Shaopan Zhang, Weiqing Yang,
Qiang Zhou, Jinqing Zhao and Guangzhao Lu
China Research and Development Academy of Machinery Equipment, Beijing, 100089, China

Keywords: Damage Effect, Simulation, Evaluation System, Design Method.

Abstract: This paper presents a design method of damage effect basic management model. The method consists of system control component, process playback component, database component, etc. The system control component realizes the functions of starting, pausing, resuming and ending the simulation. The process playback component realizes the simulation playback function in the distributed interactive environment. The database component realizes the functions of data recording, data management and data analysis. Based on this method, the basic components and software framework of damage effect simulation are realized, which strongly supports the damage effect simulation.

1 INTRODUCTION

The basic management model of damage effect simulation realizes the basic components and software framework of damage effect simulation, which is composed of system control components, process playback components, database components and other components. (Zhang, 2008; Chen, 2015; Yin, 2015; Guo, 2018)

2 SYSTEM CONTROL COMPONENTS

1) Composition
In order to realize the four functions of simulation start, pause, continue and end, the system control component is composed of four models, including: controlled object query model, control instruction release model, controlled node listening model, response information receiving, statistics and prompt model, as shown in the figure below.

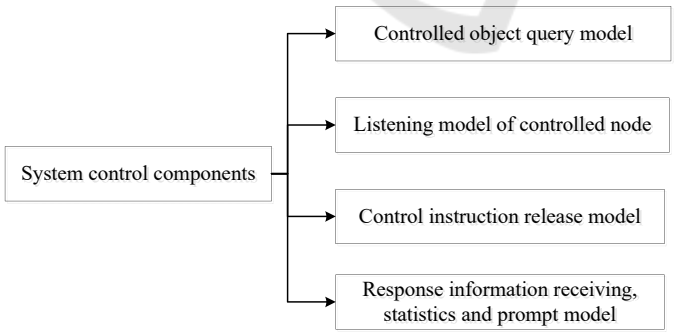

Figure 1: Composition of system control components.

2) Design
(1) Design of controlled object query model
Open the simulation node computer database and manage the selected computer in the database. (Zhao, 2020)

(2) Design of control instruction release model
The process of sending system control commands and listening by the controlled computer listener in the control instruction release model is shown in the figure below.

Sun, Y., Wang, H., Zhang, S., Yang, W., Zhou, Q., Zhao, J. and Lu, G.
A Design Method of Damage Effect Basic Management Model.
DOI: 10.5220/0012042600003620
In *Proceedings of the 4th International Conference on Economic Management and Model Engineering (ICEMME 2022)*, pages 713-717
ISBN: 978-989-758-636-1

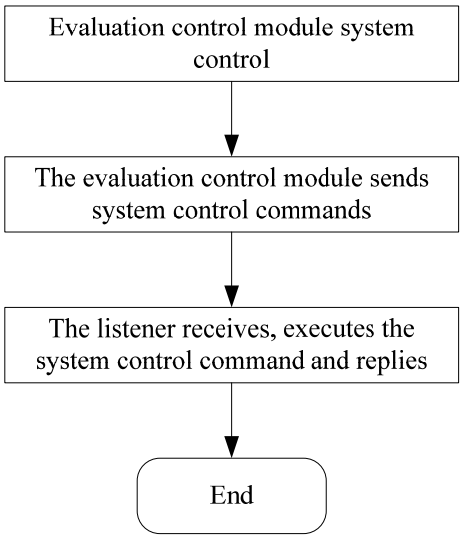

Figure 2: Flow chart of control instruction release model.

During system control of the target computer, the interaction sequence of various information is shown in the following system control sequence diagram. (Chu, 2020)

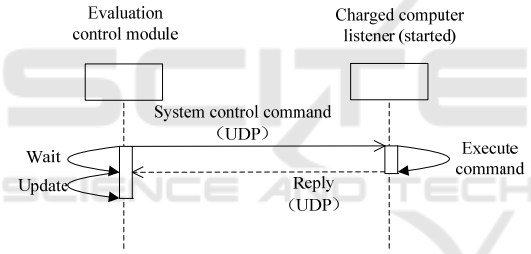

Figure 3: System control sequence diagram.

The system control commands issued by the control instruction release model are recorded in the form of database files. The specific contents of the database file include: serial number, program name, program status, name of the computer where the program is located, IP address of the computer where the program is located, path of the computer where the program is located, remarks, etc. (Gao, 2019)

(3) Design of listening model of controlled node

Receive, execute, record and respond to the simulation start, pause, continue and end commands sent by the control instruction release model. After receiving the control command, the controlled end will prompt in the form of text, image, sound, etc.

(4) Design of response information receiving, statistics and prompt model

The received response information is displayed in the message window of the software and recorded in the form of data file. The component clears the last recorded data every time it starts.

3 PROCESS PLAYBACK COMPONENT

1) Composition

The process playback component consists of three models, including: simulation countermeasure information reading model, simulation time control model and simulation countermeasure information release model, as shown in the figure below.

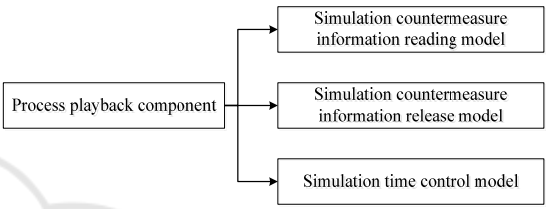

Figure 4: Composition of process playback model.

2) Design

Playback in distributed interactive environment.

(1) Design of simulation countermeasure information reading model

Before playback, read all simulation countermeasure information (including entity status information, firing information, explosion information, damage information, etc.) into the computer memory.

(2) Design of simulation time control model

Set a time cycle to control the start time of playback, playback speed (real-time, proportional real-time, super real-time), and jump (forward and backward).

(3) Design of simulation countermeasure information release model

Obtain the current simulation time t from the time cycle, set the simulation step as $\triangle T$, and query whether there is simulation countermeasure information in $(t, t + \triangle T)$ within any simulation step. If so, release the information.

4 DATABASE COMPONENTS

The database component consists of data record model, data management model and data analysis model.

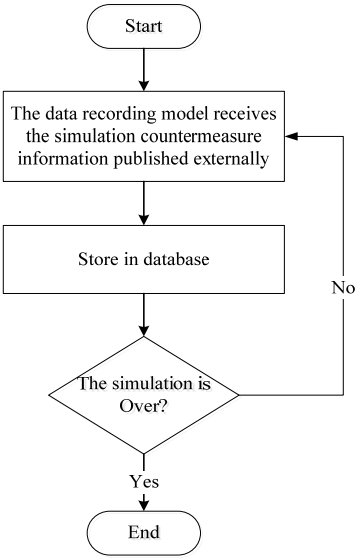

Figure 5: Operation flow chart.

4.1 Data Recording Model

The model records the simulation data in real time, receives the simulation data in real time through the HLA interface, and writes the data into the SQL Server database system in the specified format through SQL statements. (Wang, 2017)

4.2 Data Management Model

1) Model composition
The composition of the data management model is shown in the figure below.

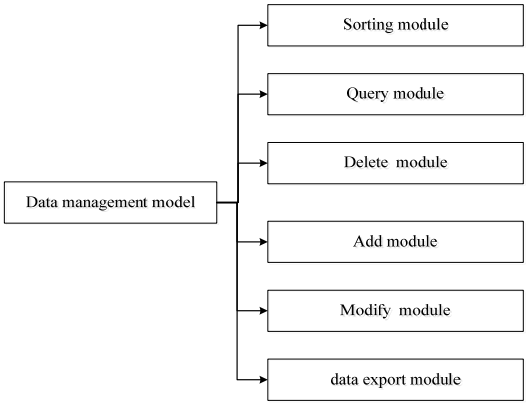

Figure 6: Composition of data management model.

2) Design of sorting module
In the visual operation interface, the user can specify to arrange the data records in ascending or descending order according to different fields.

3) Design of query module
Select the query button in the visual operation interface, fill in the corresponding fields in the pop-up dialog box and confirm. Send a query request to the SQL Server database system by generating the SQL statement of query data, get the data records that meet the conditions and return.

4) Design of delete module
In the visual operation interface, select the data record to be deleted, click the delete button and confirm. By generating the SQL statement to delete the data, send a delete request to the SQL Server database system, complete the delete operation and return.

5) Design of add module
Select the Add button in the visual operation interface, fill in the corresponding fields in the pop-up dialog box and confirm. Send an add request to the SQL Server database system by generating the SQL statement to add data, complete the add operation and return.

6) Design of modify module
In the visual operation interface, select the data record to be modified, click the Modify button, modify the corresponding fields in the pop-up dialog box and confirm. By generating the SQL statement to modify the data, send the modification request to the SQL Server database system, complete the modification operation and return. (Xu, 2021)

7) Design of data export module
Data export is to save a copy of all tables, including various management data tables, and complete the backup of the database through the basic functions of SQL Server database system.

4.3 Data Analysis Model

1) Composition

The composition of the data analysis model is shown in the figure below, including war damage statistics component and ammunition consumption statistics component.

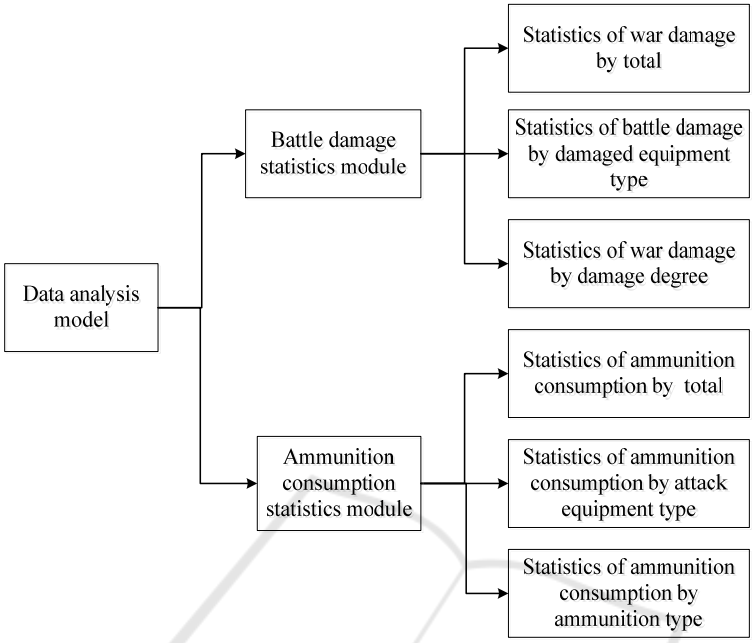

Figure 7: Composition of data analysis model.

2) Design

The war damage of the overall is counted. According to the received damage information, count the number of damaged equipment according to the overall situation and output it in table.

The war damage is counted according to the type of damaged equipment. According to the received damage information, count the damage quantity of equipment according to the type of damaged equipment, and output it in table. (Li, 2018)

The war damage is counted according to the damage degree. According to the received damage information, count the damage quantity of equipment according to the damage degree of equipment, and output it in form.

Ammunition consumption is calculated according to the overall situation. According to the received firing information, count the ammunition consumption according to the overall quantity, and output it in a table.

Count ammunition consumption according to the type of attack equipment. According to the received firing information, count the ammunition consumption according to the overall quantity, and output it in a table.

Count ammunition consumption by ammunition type. According to the received firing information, count the ammunition consumption according to the ammunition type and output it in table.

5 CONCLUSION

This paper presents a design method of damage effect basic management model. Based on this method, the basic components and software framework of damage effect simulation are realized. This method is composed of system control components, process playback components, database components and so on.

REFERENCES

Chen Feng. Study on the Simulation Technology of 3D Visualization of Target Missile Intersection. Shenyang Ligong University, (2015).

Chu Shanyong. Study on the Equivalent Evaluation of the Damage Power of the High Explosive Projectile. Shenyang Ligong University (2020).

Gao Ruiyuan, Fan Hanyang, Fan Hongming. Research on Damage Effect Assessment Method of Aircraft Targets. Fire Control & Command Control, 44(8):136-140 (2019).

Guo Guangquan, Guo Ziyun, Lei Wenxing, Zhang Jun, Fu Jianping, Chen Zhigang. Study on the Distribution Law of Dynamic Fragment Power Field of the Blast and Fragmentation Warhead. Journal of North University of China (Natural Science Edition), 39(04): 408-414 (2018).

Li Feng, Shi Quan, Sun Zheng. Summary of Technical Research on the Evaluation of Target Mutilation. Journal of Sichuan Ordnance, 39(9):69-72 (2018).

Wang Hua, Xin Tengda, Cui Cunyan, Wang Yan, Zhao Beilei, Zhao Jiguang. Summary of Weapon Damage Assessment Research Methods. Journal of Equipment Academy, 28(1):105-110 (2017).

Xu Yuxin, Cai Zilei, Wu Wei, Zhao Pengduo, Qiao Zhijun. Current Research and Development of Ammunition Damage Effect Assessment Technology. Transactions of Beijing Institute of Technology, 41(6):569-578 (2021).

Yin Peng. The Research on Visual Simulation of Damage Assessment of Large-caliber explosive grenades [D]. Beijing Institute of Technology, (2015).

Zhang Zhichun, Qiang Hongfu, Sun Xinli. Numerical simulation for fragments flight characteristics of high explosive projectile. Journal of PLA University of Science and Technology (Natural Science Edition), 9(06):671-675 (2008).

Zhao Hongzhi, Zhang Jian, Liang Zhengang, Yuan Zhihua. Research on Power Accurate Evaluation of the Blast-Fragmentation Warhead with Preformed Fragments. Computer Simulation, 37(01):15-21 (2020).