Integration of the Unit Modules of the Nuclear Facility Dismantle Simulation System

Ikjune Kim*, ByungSeon Choi, Dongjun Hyun, JeiKwon Moon, Jonghwan Lee, KwanSeong Jeong, and Shinyoung Kang
Korea Atomic Energy Research Institute, 111, Daedeok-daero 989beon-gil, Yuseong-gu, Daejeon, Republic of Korea
*ikjunekim@kaeri.re.kr

1. Introduction

The dismantling of nuclear facilities takes a very long time and is a dangerous procedure. Thus, it should go through a process optimization procedure based on the process simulation. The process simulation pre-evaluates the operation time and cost, and checks the possibility of danger of the dismantling procedures, thereby enhancing the safety of the dismantling [1]. We developed unit modules for flexible dismantle simulation system, Cutting simulation module, Human dose calculation module and Scenario assessment module. And we integrate all the modules we implement to use for scenario assessment.

2. Unit modules

In this chapter, we introduce the modules of the main functionalities of the dismantle simulation system.

2.1 Cutting Simulation module

The Cutting simulation module provides the instant cutting function of the target model. Also a user can input arbitrary cutting path of various combinations of the cutters and carriers to create a cutting activity by haptic device as well as Graphical User Interface (GUI). And the cutting activity can be updated during scenario modeling procedure. Fig. 1 shows an example scenario of cutting simulation. In the Fig. 1 target model (upper internal) is cut by a circular saw which is carried by robot manipulator.

2.2 Human dose calculation module

The worker dose rate is calculated based on worker path and working time in the simulation system. A user can easily model the working path and working motion of the worker by using the human manikin model in the simulation system and based on the dose rate of the model we can calculate a worker dose rate. Fig. 2 shows an example of worker dose calculation.

2.3 Scenario assessment module

After modeling the scenario, using the Scenario assessment module, a user can calculate the cost and time of the scenario based on each activity in it.

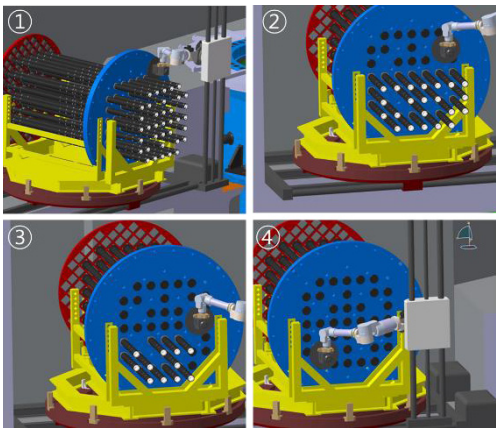

Fig. 1. Cutting Simulation.

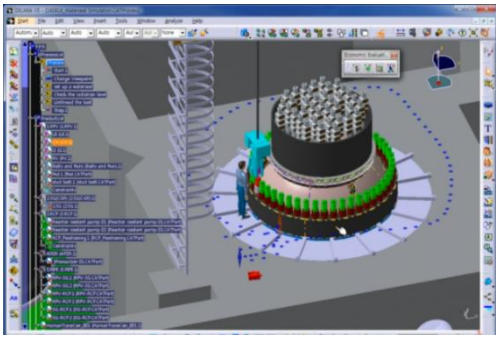
Fig. 2. Example of worker dose calculation.

3. Integration of the modules

Each module is implemented as a Dynamic Linked Library (DLL). And all modules are bound to the simulation system at runtime. The system structures are shown in Fig. 3. Functional module are placed top position of the diagram and those modules refer to the common module which provides interfaces of the Delmia System.

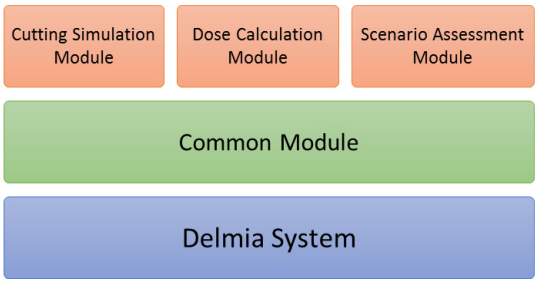

Fig. 3. System Integration Scheme.

4. Conclusion

Previously, we implemented necessary functions to simulate the dismantle process of the nuclear facility which are implemented in each module. And finally we integrate all the modules to evaluate the dismantle scenario quantitatively. In the future, this system framework can be used scenario optimization based on scenario assessment result.

Acknowledgements

This work was supported by the nuclear research and development program through the national research foundation of Korea funded by the Ministry of Science, ICT & Future Planning.

REFERENCES

[1] I. Kim, B. Choi, D. Hyun, J. Moon, J. Lee, K. Jeong, et al., A framework for a flexible cutting-process simulation of a nuclear facility decommission, Annals of Nuclear Energy, vol. 97, pp. 204-207, 2016.

[2] G. Ryu, et al., Guidance weapon assembly simulation using the DELMIA. KSAS Conference 2008, Vol. 2, p. 1220-1223, 2008.

[3] I. Kim, et al., Cutting Method of the CAD model of the Nuclear facility for Dismantling Simulation, Transactions of the Korean Nuclear Society Spring Meeting, Jeju, Korea, May 7-8, 2015 Journal of Nuclear Fuel Cycle and Waste Technology, 1(1), 1-10 (2015).