

# Establishment of Technology Requirements for Environmental Information Feedback to Dismantle Core Facilities of Nuclear Power Plants

Jonghwan Lee\*, Ikjune Kim, Sungmoon Joo, Dongjun Hyun, and Shin Young Kang

Korea Atomic Energy Research Institute, 111, Daedeok-daero 989beon-gil, Yuseong-gu, Daejeon, Republic of Korea

\*jhl@kaeri.re.kr

## 1. Introduction

The dismantling process of nuclear facilities with high radioactivity is a complex process requiring various technologies and equipments while being economical and safe. Lack of dismantling site information causes process inefficiency in dismantling process [1]. If the environmental information of the dismantling site is linked to the remote cutting system in real time and reflected directly to the planned dismantling process, the process can be corrected and supplemented in a short time, and the economical efficiency and efficiency of the dismantling process can be further improved. This study explains the requirements of environmental information feedback technology to reflect environmental information instantly on dismantling site in dismantling process.

## 2. Preprocessing for dismantling environmental information feedback

In general, data for optically acquiring surface coordinate information and related attributes of an object is stored in the form of a point cloud having three-dimensional coordinates. In the case of a large object such as a nuclear core facility, in order to scan the entire surface optically, the position and orientation of the scanner are changed and scanned at various positions and angles. The three-dimensional point cloud data corresponding to the scenes scanned at different positions and angles need to be transformed into a single coordinate system and merged. Since the point cloud created through this process is a set of simple three-dimensional points, it must be modeled again as a three-dimensional geometry using a manual or appropriate (automatic

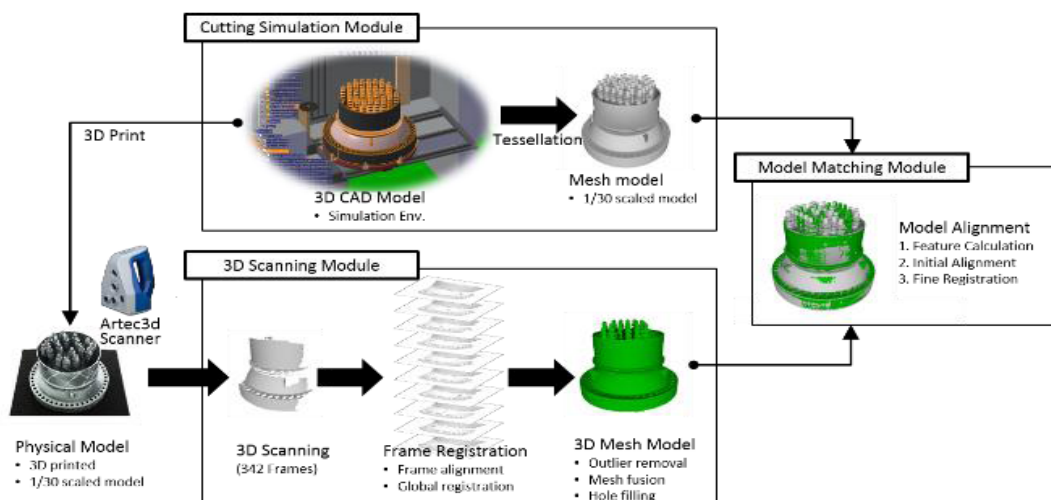


Fig. 1. Overall configuration of the software test bed for the environmental information feedback system.

or semi-automatic) algorithm for comparison analysis with the design information of the dismantling target.

### **3. Establishment of technology requirements with environmental information feedback test bed**

Even if a three-dimensional model with high accuracy is obtained by acquiring the environmental information of the dismantling site, it is necessary to analyze the deviation by comparing it with the three-dimensional model of the dismantling process simulation in order to reflect it in the dismantling process simulation. If necessary, the three-dimensional model of the existing simulation should be updated again based on the three-dimensional environment information obtained from the dismantling site. This process needs to deal with not only simple shape information but also semantic information. The goal of the test bed for the environment information feedback is to set the technical requirements for feedback of the dismantling environmental information by performing a matching test between the scan model of the actual mockup and the CAD model of the simulation environment. Figure 1 shows the overall configuration of the software test bed for the environmental information feedback system. The technical requirements of the environmental information feedback system derived from the multiple tests with the actual mockup output by the 3D printer using this test bed are as follows.

- Consider the local feature description method for feature calculation because the scan model does not have perfect shape.
- Both models require sampling of the same

resolution dataset for improved matching accuracy.

- In CAD model, point sampling is needed not only in vertex coordinates but also in face.
- Diversification of future feature extraction method according to the shape of the model

### **4. Conclusion**

The environmental information feedback system will be continuously improved through the test bed based on the derived technical requirements. This technology is one of the key technologies for the advanced remote dismantling systems and is expected to provide a new approach for economical and safe dismantling of high radioactivity core facilities.

### **ACKNOWLEDGEMENT**

This work was supported by the nuclear research and development program (2017M2A8A5015146) through the National Research Foundation of Korea, funded by the Ministry of Science and ICT, Republic of Korea.

### **REFERENCES**

- [1] J. Lee, G.-H. Kim, I. Kim, D. Hyun, K.S. Jeong, B.-S. Choi and J. Moon, "Establishment of the framework to visualize the space dose rates on the dismantling simulation system based on a digital manufacturing plat-form", *Annals of Nuclear Energy*, 95, 161-167 (2016).