Design of an Actuation Module for a Cathode Basket Lifting Mechanism

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1. Introduction

Pyroprocessing, a method to recycle spent fuels, has been studied to reduce down high radiation waste. The facilities such as PRIDE and ACPF have been constructed to perform engineering scale experiments at KAERI (Korea Atomic Energy Research Institute). In order to maintain systematic operation and stable performance of the process equipment, a way to automation should be considered in process operation.

The PAVM (Pyroprocessing Automation Verifying Mockup) was proposed to provide the experimental space dedicated to the mechanical feasibility of equipment, including automation function [1].

In this study, an actuation module for a basket lifting mechanism of equipment in PAVM is discussed.

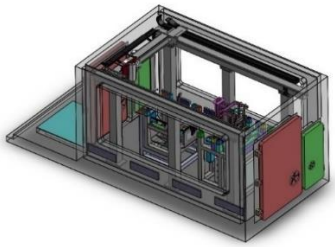

Fig. 1. PAVM (Pyroprocessing Automation Verifying Mockup).

2. Actuation module for cathode basket lifting mechanism

2.1 Automation concept of basket lifting module

Pyroprocessing is composed of several sub-processes, including an electrolytic reduction process.

The purpose of the electrolytic reduction process is to turn the uranium oxides to uranium metals. The oxides fuels are loaded at cathode in molten LiCl containing Li_2O so as to dissolve oxide ions. The basket-shaped cathode should be replaced at each batch of the oxide reduction process [2].

The repeated operations of basket to immerse into and put out of molten salt are difficult and dangerous. Only with the manual remote operation, it is not reliable and safe. Some dedicated mechanism is desirable.

For simple and convenience handling of the cathode basket, the basket lifting module was proposed. It was designed as an assembly of four modules, a testing basket, a basket socket, a fork lift module, and an actuation module, as shown in Fig. 2.

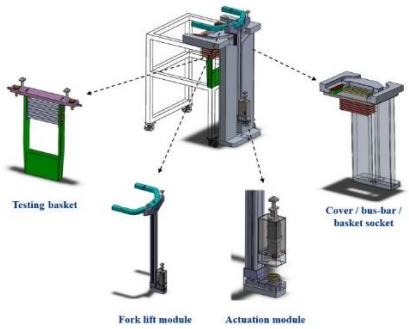

Fig. 2. A modular design of the basket lifting mechanism.

The mechanism is modularized and the basket automatically moves by lifting module.

2.2 Design of the actuation module

The actuation module in basket lifting mechanism

is designed to meet two requirements. The first is easiness of combine, and the second is simultaneous electric connection when the module is mechanically combined. To meet the first requirement, tapered guide faces are shaped on the contact surfaces. A mechanical coupler for torque transmission is compliant for convenience in attachment. For the second requirement, the spring loaded pins were utilized. Spring loaded pin, acting as a connector, contacts provide a reliable electrical and mechanical connection. As a feature of the spring loaded pin, the electrical power and signals to actuation module are keep connected reliably in the cases of uneven mating surfaces, different floating heights, or even exposure to extreme vibration. The figure 3 shows the spring loaded pin.

Fig. 3. Spring loaded pin.

Due to the electrical integration by the spring loaded pins, as a power source, the mechanical connection of the actuator and the basket lifting module is activated. And then, a motor gear is engaged to drive the belt and actuate the lift module.

The actuator are designed as modules which have a docking knob is attached on the top of the actuation module, considered to be easily maintained by using the automated handling device [3].

When the actuation module is simply loaded on the assembly, the tapered faces guide and align the actuation modules to the exact position. The weight of the actuation modules pushes the spring loaded pins to keep contact electrically.

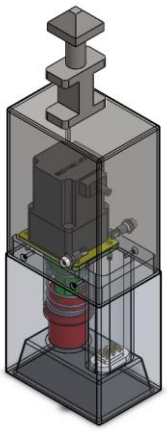

Fig. 4. Mechanical and electrical integrated connection actuation module.

3. Conclusion

The actuation module for basket lifting mechanism was designed in this research. The main concept of actuator is to utilize a spring loaded pin embedded in the module as a connector. After the pin is electrically connected, the motor is activated to move the fork lift module. In terms of maintenance, a docking knob was designed on the top of the actuator to make it easy to handle automated device.

REFERENCES

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