Development of the Log-in Process and the Operation Process for the VHTR-SI Process Dynamic Simulation Code

Jiwoon Chang, Youngjoon Shin, Cheung Youn*, Jihwan Kim, Kiyoung Lee, Wonjae Lee, Jonghwa Chang
Korea Atomic Energy Research Institute150 Dukjin-dong, Yuseong-gu, Daejeon, Korea 305-600
*Chungnam National University, 220 Gung-dong, Yuseong-gu, Daejeon, Korea 305-764
E-mail;jwjang73@kaeri.re.kr, Tel; +82 42 868 8369, Fax; +82 42 868 8549

1. Introduction

The VHTR-SI process is a hydrogen production technique by using Sulfur and Iodine. The SI process for a hydrogen production uses a high temperature (about 950 ℃) of the He gas which is a cooling material for an energy sources. [1]

The Korea Atomic Energy Research Institute Dynamic Simulation Code (KAERI DySCo) is an integration application software that simulates the dynamic behavior of the VHTR-SI process.

A dynamic modeling is used to express and model the behavior of the software system over time. The dynamic modeling deals with the control flow of system, the interaction of objects and the order of actions in view of a time and transition by using a sequence diagram and a state transition diagram. [2]

In this paper, we present an user log-in process and an operation process for the KAERI DySCo by using a sequence diagram and a state transition diagram.

2. Methods and Results

A sequence diagram depicts the sequence of actions that occur in a system. A sequence diagram in Unified Modeling Language (UML) is a kind of interaction diagram that shows how processes operate with one another and in what order. It is a construct of a message sequence chart.

Some systems have a simple dynamic behavior that can be expressed in terms of specific sequences of messages between a small, fixed number of objects or processes. In such cases sequence diagrams can completely specify system's behavior.

State transition diagrams are used to describe the behavior of a system. State diagrams describe all of the possible states of an object as events occur. Each diagram usually represents objects of a single class and tracks the different states of the objects through a system.

In this study, we have use the Smartdraw software by the UML tool. [3]

2.1 Sequence diagram

A sequence diagram of a user log-in process in a VHTR-SI process dynamic simulation code is presented in Figure 1. As shown Figure 1, the sequence diagram shows the user log-in process of the KAERI DySCo and the exception status for the user log-in process. The meanings of the symbols are the following:

① Parallel vertical lines ("life lines") representing different processes or objects that live simultaneously.

② Horizontal arrows representing the messages exchanged between processes or objects, in the order in which they occur.

③ Solid arrows with full heads are synchronous calls, solid arrows with stick heads are asynchronous calls and dashed arrows with stick heads are return messages.

④ An X is drawn on top of the life line when object is destroyed (removed from memory).

The scenario for the user log-in process is the following:

① User input user ID and password.

② If user ID and password is valid, the KAERI DySCo executes the View class.

③ If user ID and password is not valid, the KAERI DySCo executes a warning message box for the input error. Return to no. 1.

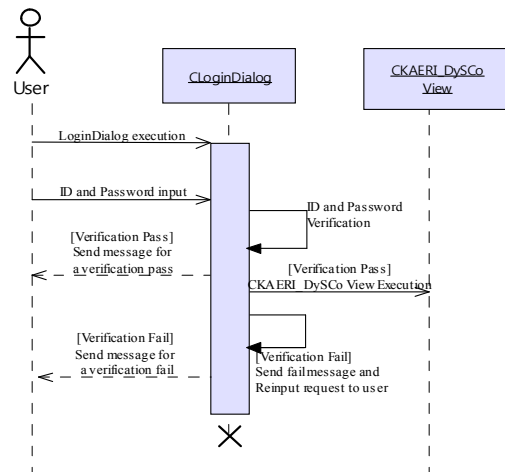④ When more than three incorrect log-in attempts, the KAERI DySCo is closed.

Fig.1. Sequence diagram for an user log-in process for the KAERI DySCo.

The Graphic User Interface (GUI) for the user log-in process based on the sequence diagram is presented in Figure 2. As shown Figure 2, the user log-in window consists of two edit boxes as user ID and password and two buttons ok and cancel. Also, presents a warning message boxes for an invalid user ID and password.

Fig. 2. User log-in window and warning message boxes.

2.2 State transition diagram

State diagrams are also used to describe the behavior of a system. State diagrams can describe the possible states of an object as events occur. Each diagram usually represents objects of a single class and tracks the different states of its objects through the system.

The UML state diagram is essentially a Harel statechart with a standardized notation, which can describe many systems, from computer programs to business processes. The following are the basic notational elements that can be used to make up a diagram:

① Filled circle, pointing to the initial state.

② Hollow circle containing a smaller filled circle, indicating the final state.

③ Rounded rectangle, denoting a state. Top of the rectangle contains a name of the state. Can contain a horizontal line in the middle, below which the activities that are done in that state are indicated.

④ Arrow, denoting transition. The name of the event (if any) causing this transition labels the arrow body. A guard expression may be added before a "/" and enclosed in square-brackets (*event Name* **[guard Expression]**), denoting that this expression must be true for the transition to take place. If an action is performed during this transition, it is added to the label following a "/" (*event Name* **[guard Expression]/action**).

⑤ Thick horizontal line with either x>1 lines entering and 1 line leaving or 1 line entering and x>1 lines leaving. These denote join/fork, respectively.

A state transition diagram for a simulator operation is presented in Figure 3. As shown Figure 3, the simulation operation process has three states as simulation running, simulation paused and log retrieval. The Simulation running state occurs by an event of start button click. In order for the state transition to occur from the initial state to the simulation running state, the simulator must not be running.

Also, as a simple example, the state transition diagram for a general reboiler is presented in Figure 4. As shown Figure 4, the reboiler has two states as the

heating state and the vapor generation state. In order for the state transition to occur form the heating state to the vapor generation state, the temperature of material in a reboiler must be higher than boiling point of itself. Here, temperature of the material in a reboiler is denoted by the T_{SA}. Boiling point for the material in a reboiler is denoted by the T_B.
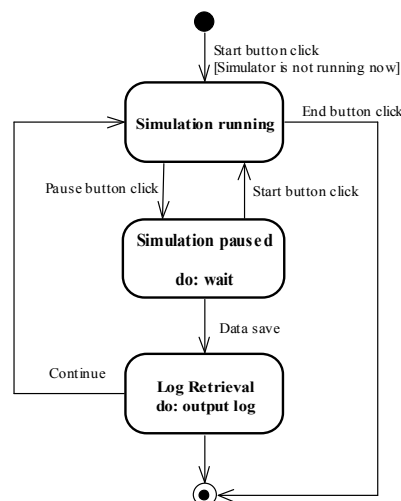

Fig. 3. State transition diagram for an operation process for the KAERI DySCo.
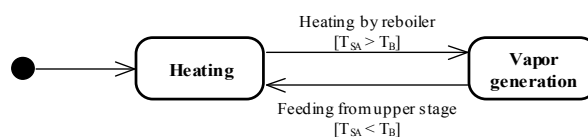

Fig. 4. State transition diagram for a reboiler.

3. Conclusion

The development of the user log-in process and the operation process for the KAERI DySCo has been done by using dynamic modeling.

For the user log-in process and the operation process for the KAERI DySCo, modeling notations were used such as a sequence diagram and state transition diagram.

Acknowledgments

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