

Developing the Simulator of Material Circulation Control System, SICLE

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More than 50 years have passed since the first human space flight had realized. Since then, a variety of Environmental Control and Life Support Systems (ECLSS) have been developed to sustain human life in space. Material circulation is the primary objective to create ECLSS and it can be achieved by utilizing plants and chemical/physical devices recycling waste materials. In the International Space Station, now, oxygen and water are recycled and the recycling system makes us possible to stay in space for a long period of time. In the future, research and development of more advanced ECLSS will be needed for construction of lunar base and manned space exploration to Mars.

As ECLSS becomes larger and more complicated, it is more important to control material circulation of the entire system. In order to support such researches, we are developing an ECLSS simulator called Simulator for Closed Life and Ecology (SICLE), aiming to take the current research streams into account, as well as to make a useful tool satisfying a wide range of research themes including optimum control of material circulation. We concern that the simulator is desired to have following two features.

- User-friendly interface with intuitive operation
- High versatility to apply new control models and functionalities

Users can visually design and follow their own systems with simple block diagrams, which contribute to easier usability. In addition, by implementing XML file template, the simulator allows users to create new types of equipment. Moreover, it is able to cover various devices' behaviors.

For future improvement, we will make it possible to incorporate new theories of control optimization method, and examine the performance of this simulator comparing real data of existing ECLSS environment.

Keywords: ECLSS,, CELSS, Material Circulation Control, Life Support System, Simulator