Resaerch of model based development for space systems at early development phase

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Abstract

Recently, there are many research with regard to model-based development approach and degialization of space systems. JAXA Reserch Unit III is developing system simulator necessary for space system design in early phase, and it can be used to improve efficiency of development time. In this project, we develop the model-based method for space systems design evaluation and risk assesment with parameter studies and Monte Carlo simulations on JSS3.

Reasons and benefits of using JAXA Supercomputer System

All JAXA employee can use JSS quickly and easily without any complicated procedures.

The system can be connected within the JAXA intranet, so there is little risk of information leakage.

Quick access to extensive support on how to use the system.

The ability to perform numerous Monte Carlo simulations in a short time by utilizing large computational resources.

Achievements of the Year

We are working on developing and applying model-based development methods for design evaluation and risk assessment with the automated docking system to evaluate dynamic behavior, including each interaction across multiphysics domains. This approach is realized using the Modelica modeling language, which allows acausal modeling of complex cyberphysical systems. Further, a reduced-order model realized by the Modelica and parallel computing availability with JSS3 are realized docking feasibility evaluation and safety measure tradeoffs.

Publications

- Oral Presentations

Kaname Kawatsu, Hirofumi Kurata, Hikaru Mizuno, "Multi-disciplinary model-based development method targeting spacecraft automated docking systems," AAS/AIAA Space Flight Mechanics, 2025.

Usage of JSS

Computational Information

Process Parallelization Methods	N/A
Thread Parallelization Methods	N/A
Number of Processes	1
Elapsed Time per Case	30 Minute(s)

JSS3 Resources Used

Fraction of Usage in Total Resources[*1](%): 0.04

Details

Computational Resources		
System Name	CPU Resources Used (core x hours)	Fraction of Usage[*2](%)
TOKI-SORA	0.00	0.00
TOKI-ST	300,548.45	0.31
TOKI-GP	925.99	0.01
TOKI-XM	0.00	0.00
TOKI-LM	0.00	0.00
TOKI-TST	0.00	0.00
TOKI-TGP	1,724.42	11.87
TOKI-TLM	0.00	0.00

File System Resources		
File System Name	Storage Assigned (GiB)	Fraction of Usage*2 (%)
/home	163.39	0.11
/data and /data2	2,433.33	0.01
/ssd	0.00	0.00

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage*2 (%)
J-SPACE	0.00	0.00

*1: Fraction of Usage in Total Resources: Weighted average of three resource types (Computing, File System, and Archiver).

*2: Fraction of Usage：Percentage of usage relative to each resource used in one year.

- **ISV Software Licenses Used**

ISV Software Licenses Resources		
	ISV Software Licenses Used (Hours)	Fraction of Usage*2 (%)
ISV Software Licenses (Total)	0.00	0.00

*2: Fraction of Usage：Percentage of usage relative to each resource used in one year.