Exploring NVIDIA Omniverse for Future Space Resources Missions

X. LI[1], C. MARTINEZ[1], O. CHRISTIDI-LOUMPASEFSKI[1], B. C. YALCIN[1], M. HUBERT DELISLE[1], G. RODRIGUEZ[2], J. ZHENG[2] and M. OLIVARES-MENDEZ[1]

[1] University of Luxembourg, Luxembourg, [2] Spacety Luxembourg, Luxembourg

Abstract

The resources of space offer a means to enable sustainable exploration of the Moon and Solar System, thus developing space resource technologies is becoming an essential topic for space-related activities internationally. However, verifying and validating such technologies on Earth conditions is challenging due to the different environmental conditions (e.g., gravity). On-ground experimental facilities that integrate high-fidelity simulation and physical systems enable close-to-real testing, which in turn help speed up the transition of space technology between development and deployment stages.

NVIDIA Omniverse recently gained interest to create photorealistic environments, and it is a promising tool to simulate space-related scenarios. Physically accurate and faithful on-orbit scenarios could be generated in Omniverse Create by integrating PhysX physics core and Pixar Universal Scene Description. Omniverse also includes a robotic simulator that connects to physical robotic systems. Various connectors between Omniverse and other platforms such as Unreal Engine, Blender, Autodesk, ParaView, and online collaboration capacity offer the possibility of importing models of space mission components, space scenes, and scientific data into Omniverse. NVIDIA Omniverse seems auspicious in terms of developing high-fidelity photorealistic simulations.

In a joint project between SpaceR and Spacety (the HELEN project), a close-to-real testing environment for validating debris removal technology is under development. Within the project, we will use Omniverse to integrate virtual and physical components, i.e., high-fidelity photorealistic on-orbit simulations with the Zero-G lab facility (robotics laboratory), for recreating reliable testing conditions. HELEN will serve to demonstrate the potential of Omniverse to enhance ground testbed for high-fidelity tests, verification, and validation, which we believe will be relevant for the development of future space resources technology. We also believe that future debris mitigation efforts should target the recovery of the resources present in the debris, which include valuable materials (Aluminium, Gold, Silver), as pointed out in [1].

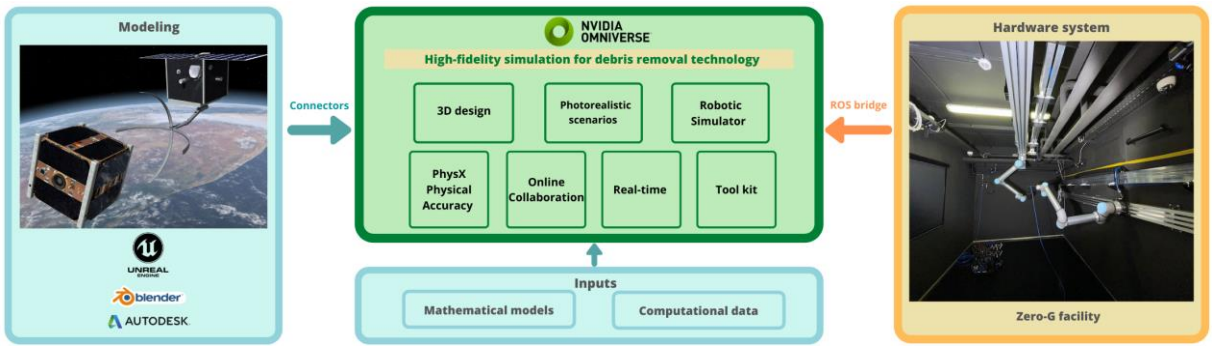

Figure 1. Omniverse for HELEN project. Left image from [2], right image Zero-G lab University of Luxembourg

References

[1] Frank Koch, The Value of Space Debris (2021), 8th European Conference on Space Debris

[2] Concept of CleanSpace One of EPFL