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Dynamical simulation of microgravity rovers

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We developed a dynamics simulator of microgravity rover for small body exploration. Surface exploration using rovers are expected to return scientific discoveries yet to be made, and for them the global and long-term operations and tactical planning are needed. However, gravity fields of small bodies are not uniform due to their irregular shapes so that it is difficult to analytically predict the rover's motion. Thus, physical-based simulation for microgravity rovers is required.

We designed the simulator to have functions to estimate the rover trajectory based on rigid-body dynamics and to visualize the trajectory data on the shape model of small body. The graphical interface has been built in to support the usability. In addition, we performed a comparative experiment in laboratory to verify the simulation of rigid-body's rebound motion.

Finally we examined characteristics of rover motion using Itokawa's shape model. As a result, we found that the rover's motion would converge for shape models of less than approximately 5-m resolution.

Keywords: simulation, dynamics, rover, Hayabusa-2