Landing Dynamics Coupled Control of Lunar Lander Based on Dual Quaternions

For lunar lander’s soft landing mission, pinpoint landing with a low velocity touch-down of the lunar lander is greatly important in the terminal landing phase. However, main descent thruster of the lander is equipped on one side along the body axis and reaction thruster for attitude control is fixed in three axes, so the dynamics of the lander could be represented as the mutually coupled. Therefore, the synthesis control law design of its thrust vector control and attitude control is important. In this paper, how the lander dynamics is coupled is shown and to resolve the coupled problem, we introduce the newly designed force-torque sequential control law. Additionally, we adjust the shape of the lander’s landing trajectory using the kinematic characteristics of dual quaternions into the smooth curved landing trajectory with lander’s attitude pitch-up. Therefore, main accomplishment of this paper is the development of the integrated translation and rotation control strategy for the terminal pinpoint soft landing of a lunar lander.