Relative attitude dynamics and control for a satellite inspection mission - DTU Orbit
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Relative attitude dynamics and control for a satellite inspection mission

The problem of conducting an inspection mission from a chaser satellite orbiting a target spacecraft is considered. It is assumed that both satellites follow nearly circular orbits. The relative orbital motion is described by the Hill–Clohessy–Wiltshire equation. In the case of an elliptic relative orbit, it is shown that an inspection mission is feasible when the chaser is inertially pointing, provided that the camera mounted on the chaser satellite has sufficiently large field of view. The same possibility is shown when the optical axis of the chaser’s camera points in, or opposite to, the tangential direction of the local vertical local horizontal frame.

For an arbitrary relative orbit and arbitrary initial conditions, the concept of relative Euler angles is defined for this inspection mission. The expression of the desired relative angular velocity vector is derived as a function of Cartesian coordinates of the relative orbit. A quaternion feedback controller is then designed and shown to perform relative attitude control with admissible internal torques. Three different types of relative orbits are considered, namely the elliptic, Pogo and drifting relative orbits. Measurements of the relative orbital motion are assumed to be available from optical navigation.

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