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Author: Mr. Robert Magner
Kepler Communications, Canada

DYNAMIC MODELING AND CONTROL PERFORMANCE FOR A CLOSED-CHAIN ROBOTIC
MANIPULATOR

Abstract

Kepler's *AETHER* Pathfinder satellites launched in late 2023 to demonstrate inter-satellite and satellite-to-ground connectivity through optical and RF links, marking the first step towards the full data relay constellation. The *AETHER* design includes a closed-chain robotic manipulator called *Skywalker*, designed for precise pointing of communications payloads. This paper focuses on the dynamic modelling and performance characterization of the robotic system. A novel approach in dynamic modeling of the closed-chain system has been derived, employing the *Householder* transformation in conjunction with *Natural Orthogonal Compliment* methods, which is validated against on-orbit data. Furthermore, a control strategy is presented for the Canfield joint that exploits the null space to reduce mechanism wear. These findings provide insights into the operational capabilities of systems like *Skywalker* to enable pointing for concurrent low-latency communication links, paving the way for more sophisticated future missions.