Objectives: To explore and validate how various orbit maintenance strategies for small satellites can be optimized for ΔV usage, by varying the tolerance bands as the independent variable.

Needs: A computationally efficient and accurate model for the rate of orbit decay, and a model small satellite in LEO as test parameters.

Summary: Three methods were proposed: one of forced-Keplerian orbits using constant thrust, one via Hohmann transfers, and one via cyclical direct burns. Results show potential for minimizing ΔV usage, and also reveal and interesting connection as tolerance bands tend to infinitesimally small values.

I. Method of Forced Keplerian Orbits

1. Keplerian orbit - idealized trajectory of motion between two bodies in space due to gravity.
2. Forced Keplerian orbit - constant thrust manoeuvre acting in the opposite direction of decay forces.

Rationale for the satellite to calculate and exert the precise thrust force needed to counteract decay forces in the opposing direction accurately throughout mission.

II. Method of Hohmann Transfers

1. Hohmann Transfer: A fuel efficient orbit manoeuvre that transfers a satellite from one circular orbit to another circular orbit.
2. Total ΔV consumed for entire manoeuvre comprises the scalar sum of two separate burns: one for entering the Hohmann transfer orbit at pericentre, and another for leaving the transfer orbit at the apoapsis.

III. Method of Cyclical Direct Burns


Results show potential for minimizing ΔV usage, and also reveal and interesting connection as tolerance bands tend to infinitesimally small values.