# Problem 1

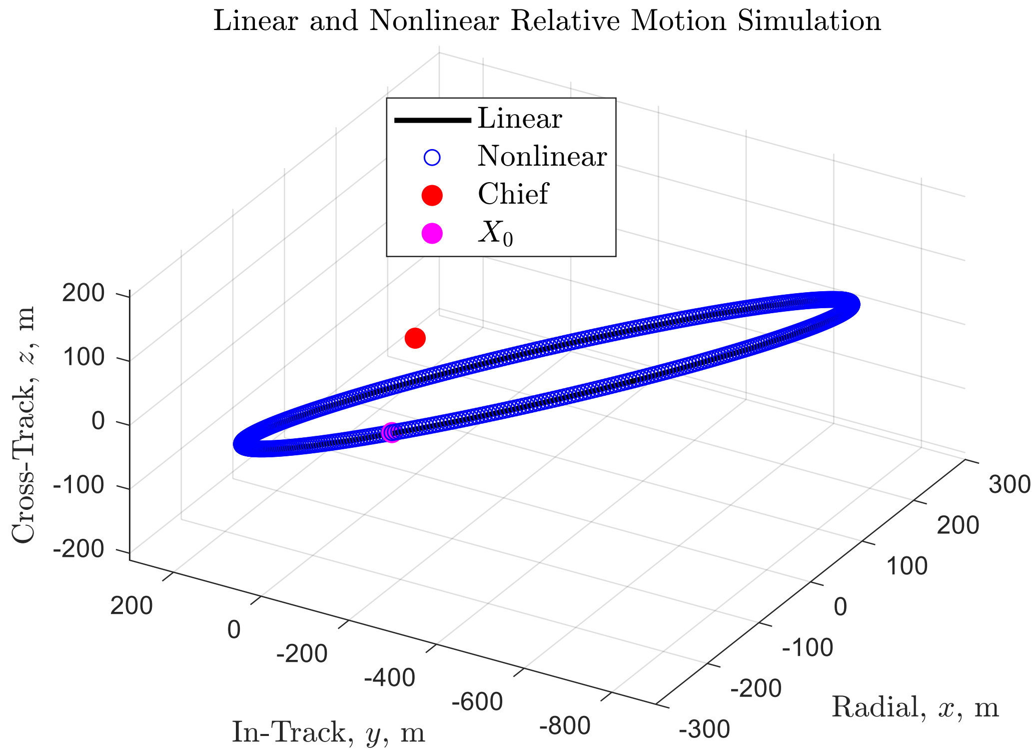


*Figure 1: Relative Motion e=0.0*

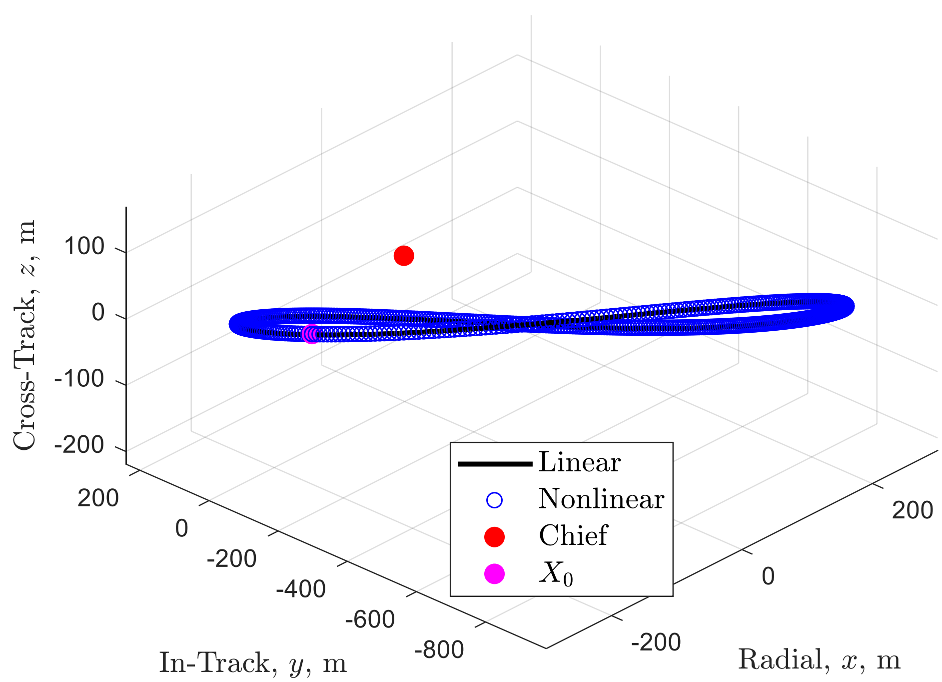


*Figure 2: Relative Motion e=0.2*

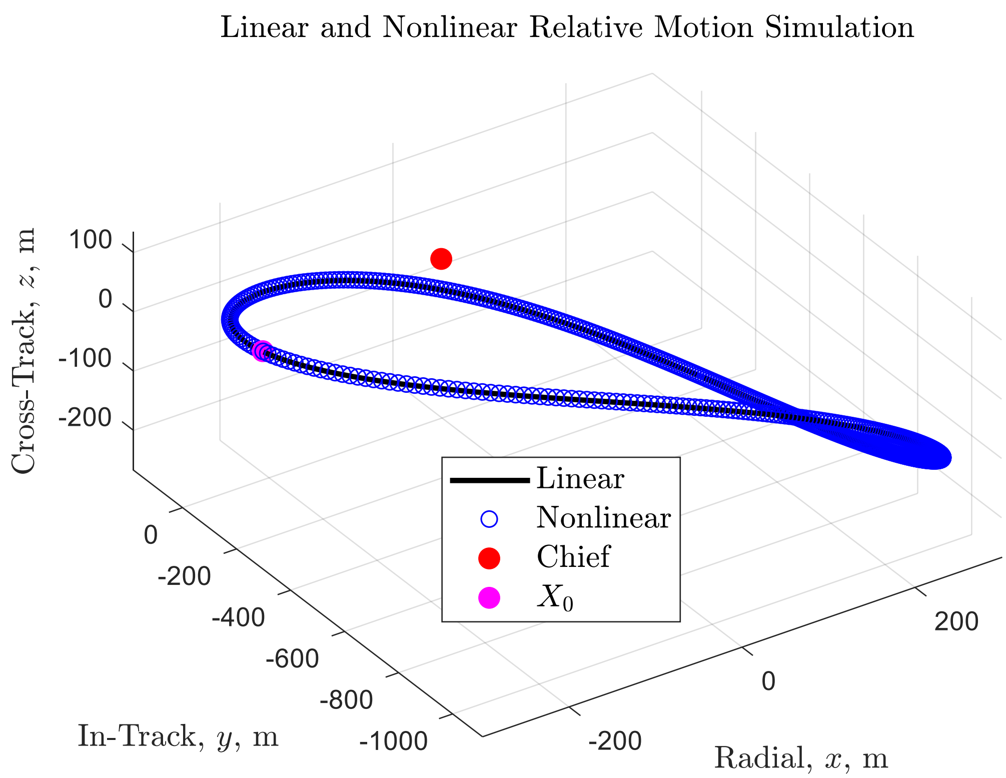


*Figure 3: Relative Motion e=0.4*

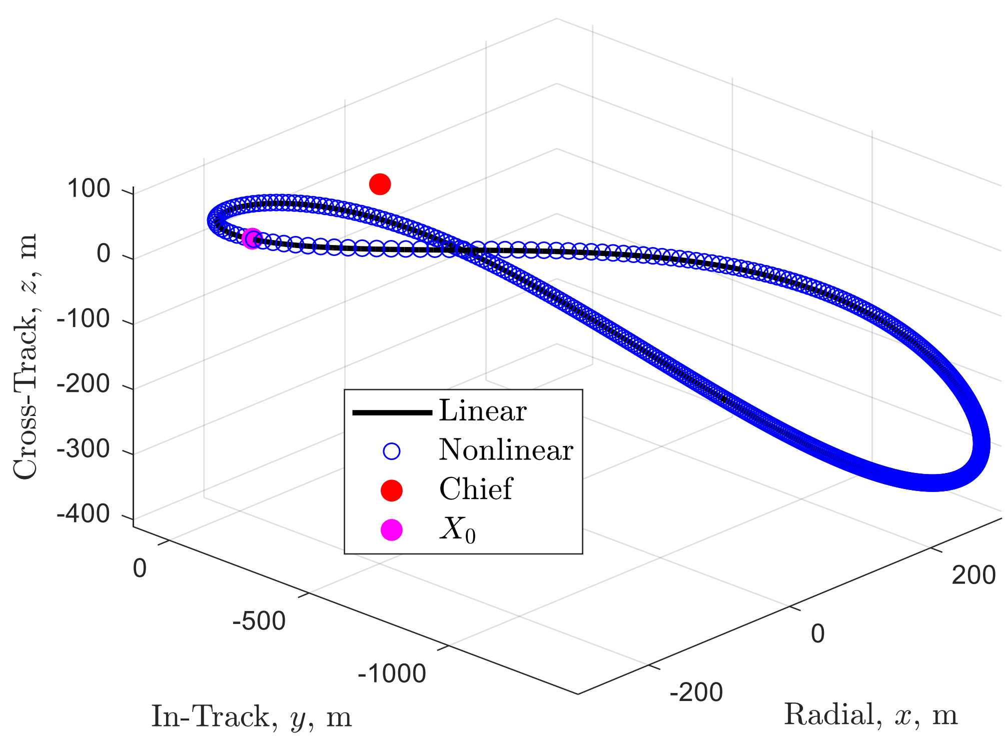


*Figure 4: Relative Motion e=0.6*

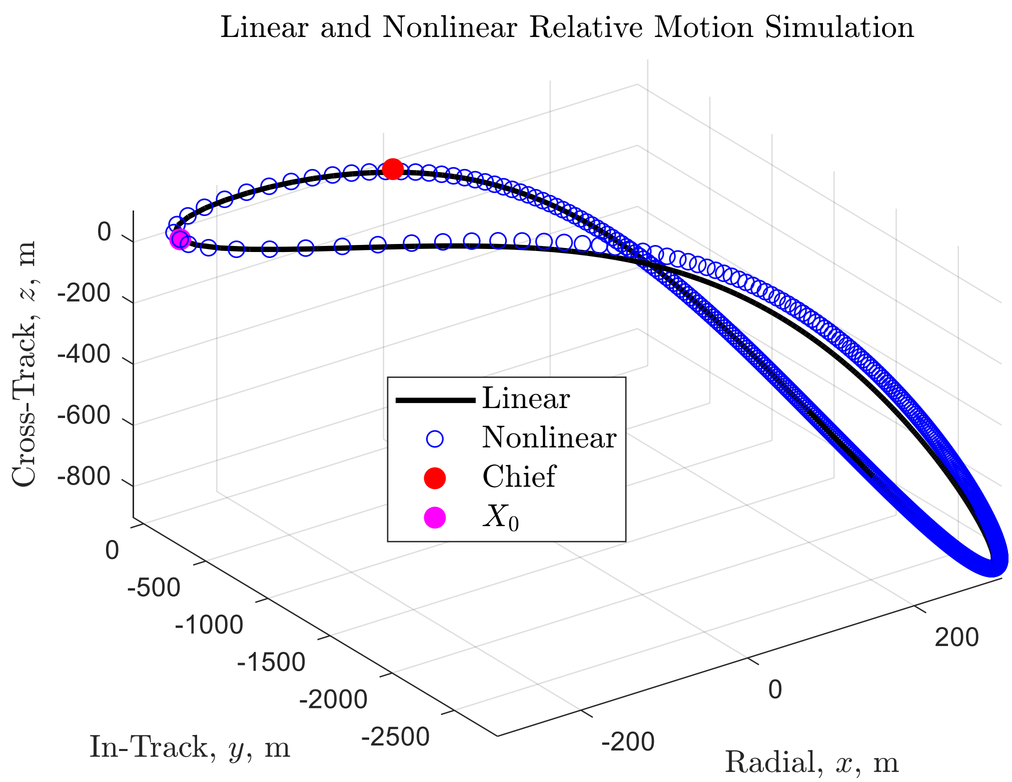


*Figure 5: Relative Motion e=0.8*

## Data

<u>Chief Orbital elements:</u>

```
a      = 7000e3;
ecc    = [0 0.2 0.4 0.6 0.8]
inc    = 45*pi/180;
raan   = pi/6;
argper = pi/6;
f0     = 0;
```

<u>Initial Conditions:</u>

```
x0 = -300;
y0 = -300;
z0 = 100;
xd0 = 0;
yd0 = eccFactor*x0;
zd0 = -0.2;
```

## Observations:

- As the eccentricity of the chief increases the magnitude of relative motion of the deputy increases. This is because of the increase in the cross-track and in-track increased relative motion.
- The motion becomes more and more out-of-plane with the increasing e of the chief. When the e is zero, the relative motion is planar.
- The speed of the deputy is faster when close to the chief, as seen in the high e value simulations.
- The linear and nonlinear simulations diverge more with increasing eccentricity of the chief.

## Problem 2

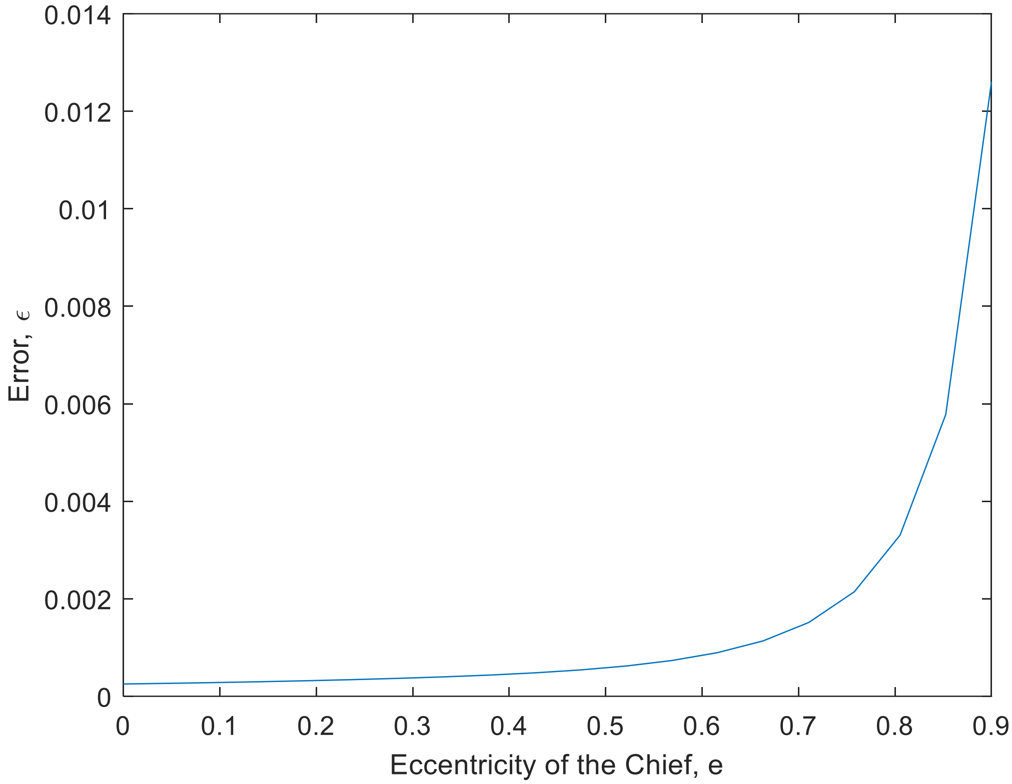


*Figure 6: Error Metric as a function of Eccentricity, for Case 2 Chief Orbit*

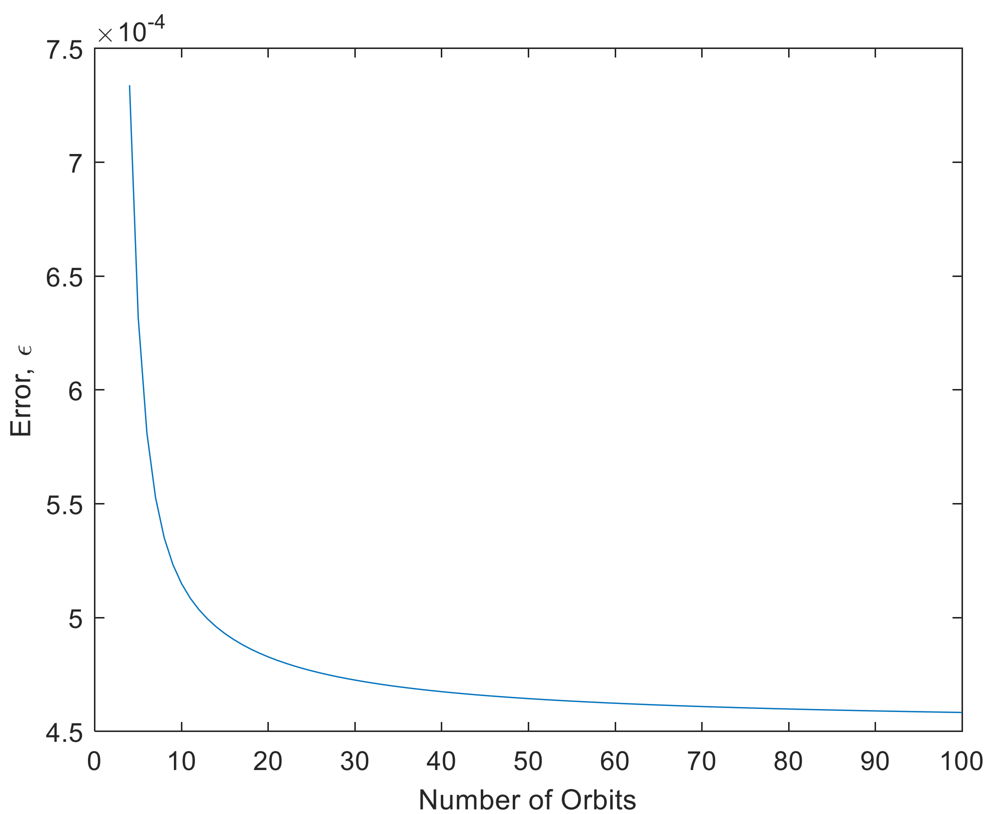


*Figure 7: Error Metric as a function of Number of orbits, for Case 2 Chief Orbit*

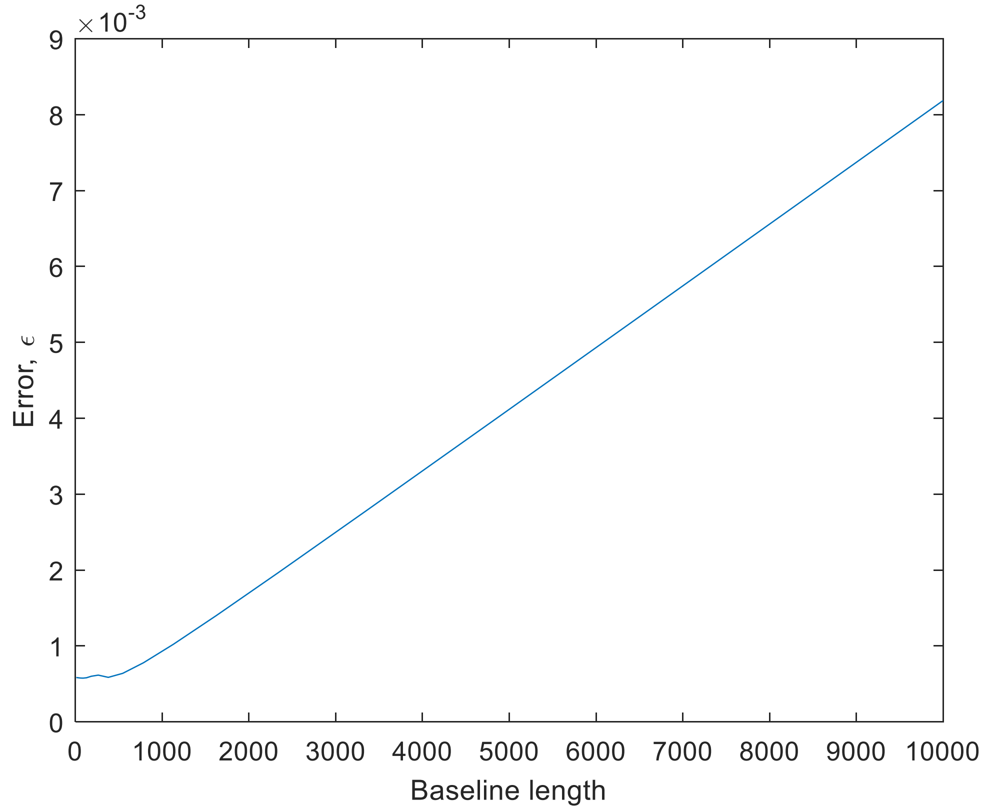


*Figure 8: Error Metric as a function of Baseline Length, for Case 2 Chief Orbit*

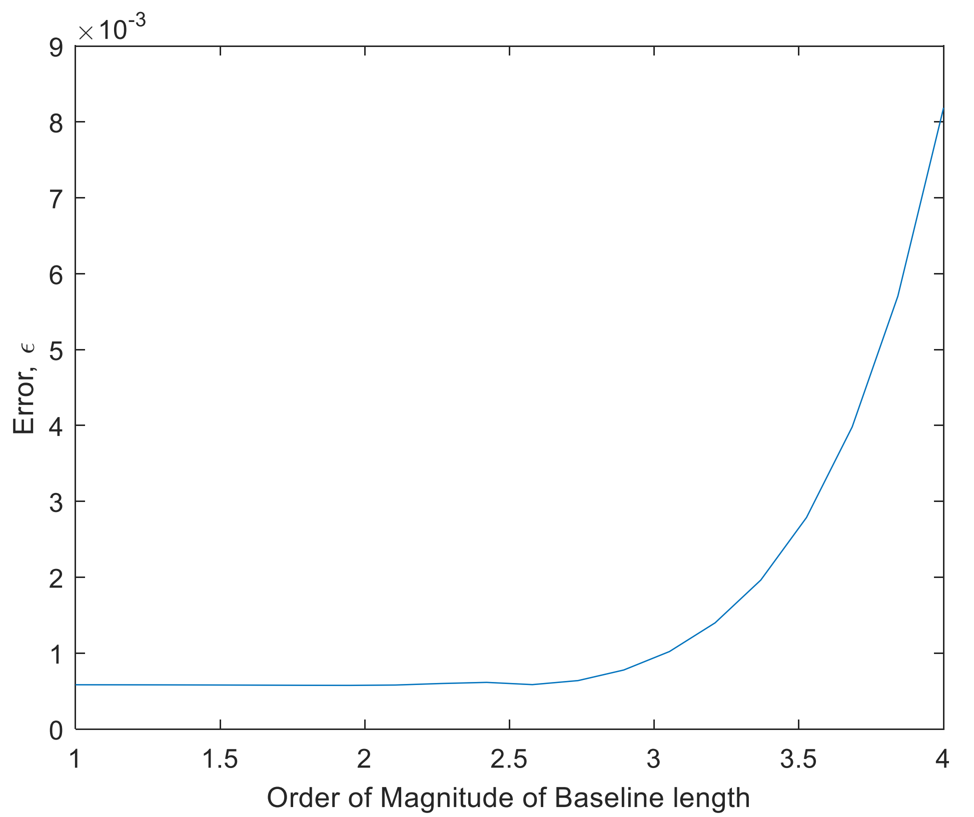


*Figure 9: Error Metric as a function of Baseline Length Order of Magnitude, for Case 2 Chief Orbit*

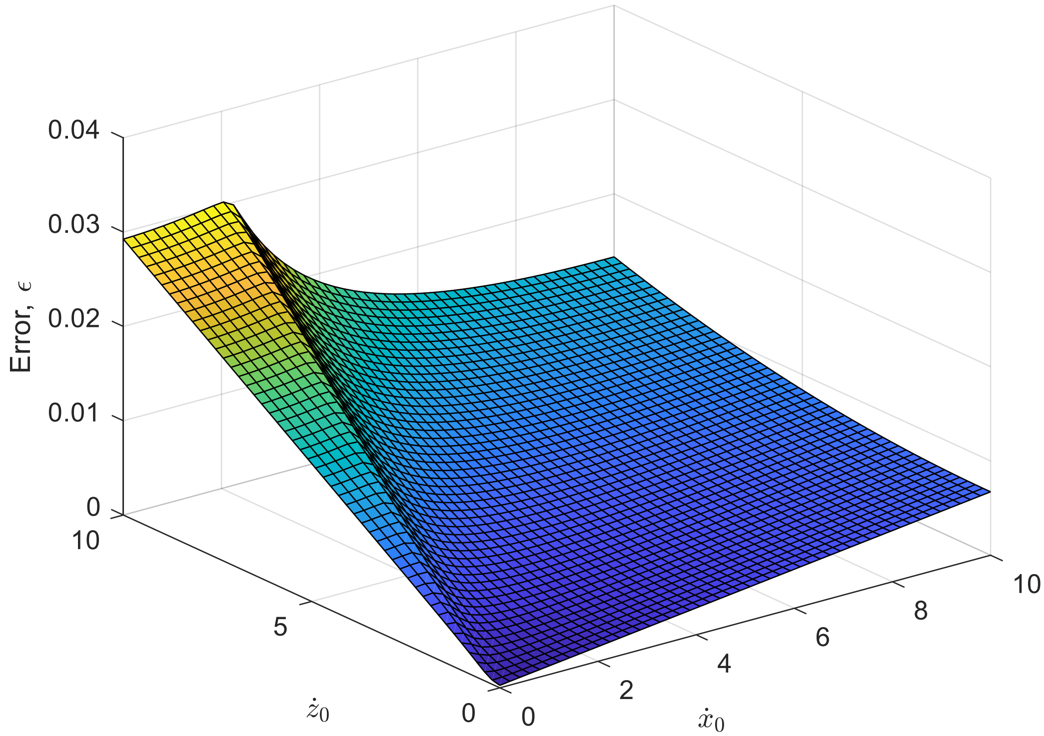


*Figure 10: Error Metric as a function of Initial x and z velocities, for Case 2 Chief Orbit*

## Question e: Which parameter impact the error metric the most?

- Eccentricity of the Chief: The error metric changes **2** orders of magnitude as the eccentricity of the chief goes from 0.1 to 0.9.
- Initial velocities $\dot{x}_0$ and $\dot{z}_0$: The initial relative velocities have huge impact on the error metric as well. The error metric changes **2** orders of magnitude here as well.