

# ASEN 6060

## ADVANCED ASTRODYNAMICS

### Recreating Motions Resembling Periodic Orbits

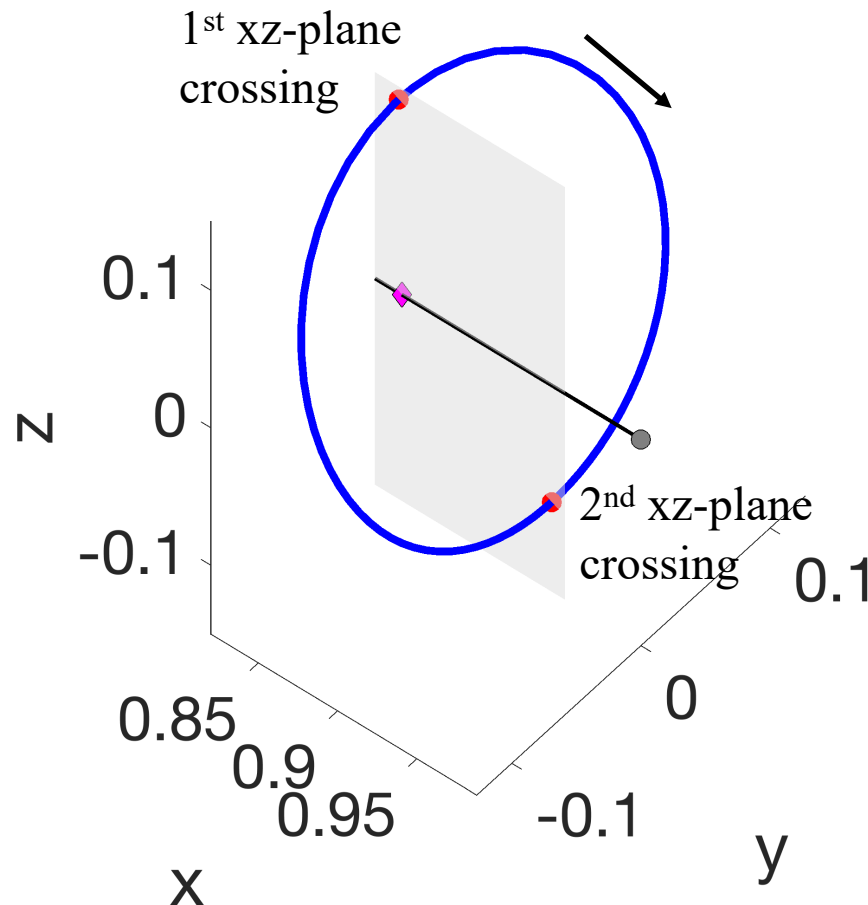
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#### Objectives:

- Briefly summarize a foundational approach to generate paths in an ephemeris model that resemble a periodic orbit

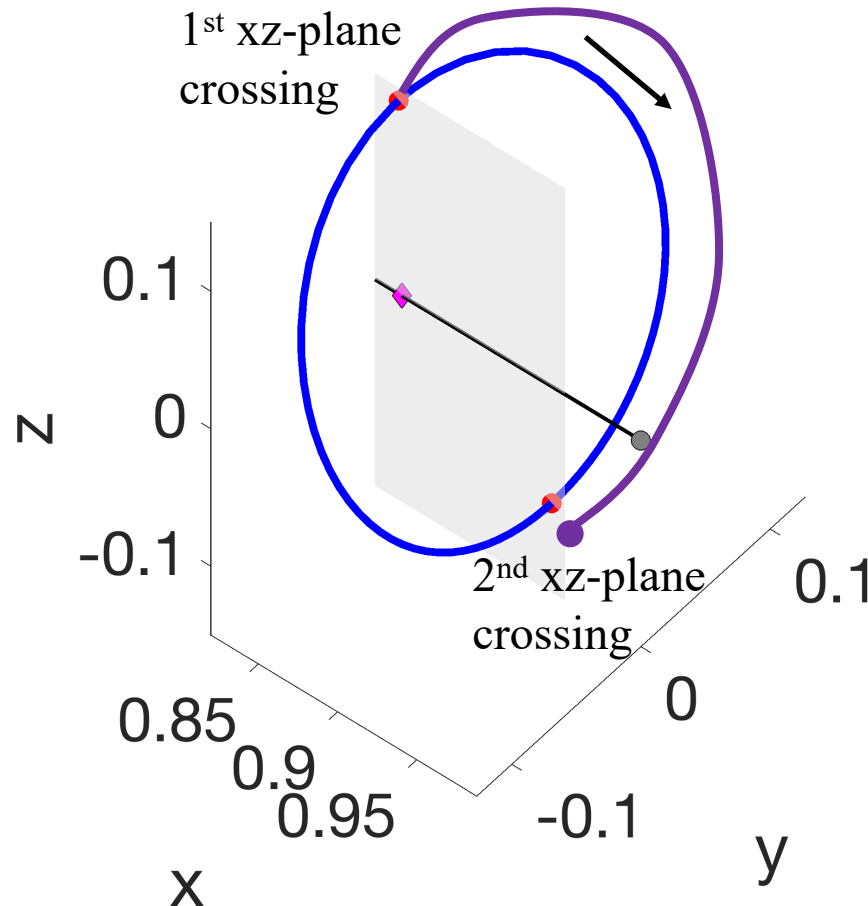
# Overview of Approach

- Target a trajectory with xz-plane crossings that are sufficiently close to that of a periodic orbit in the CR3BP



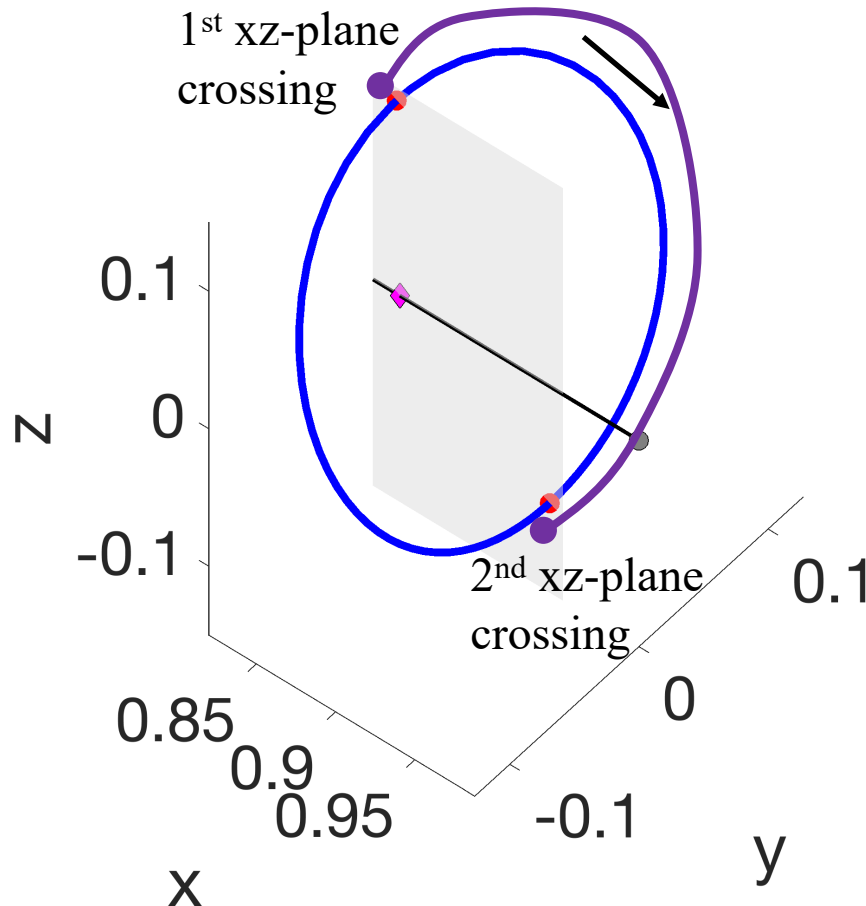
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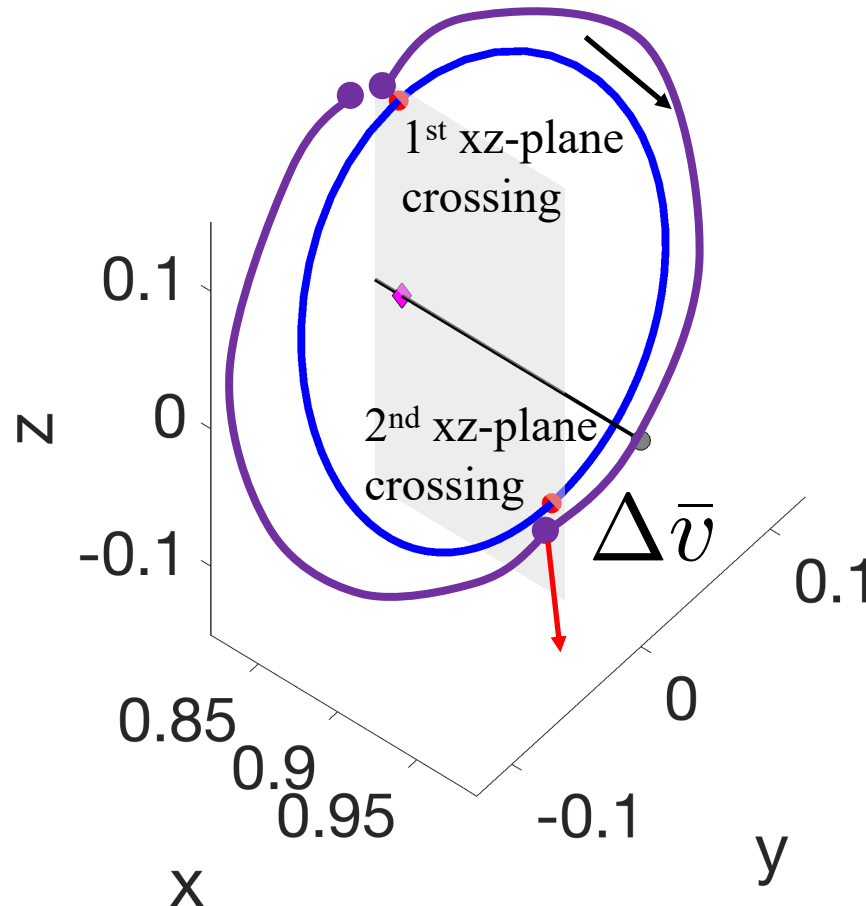
Target:

$$|x - x_{PO}| < \epsilon_x$$

$$|\dot{x}| < \epsilon_{vx}$$

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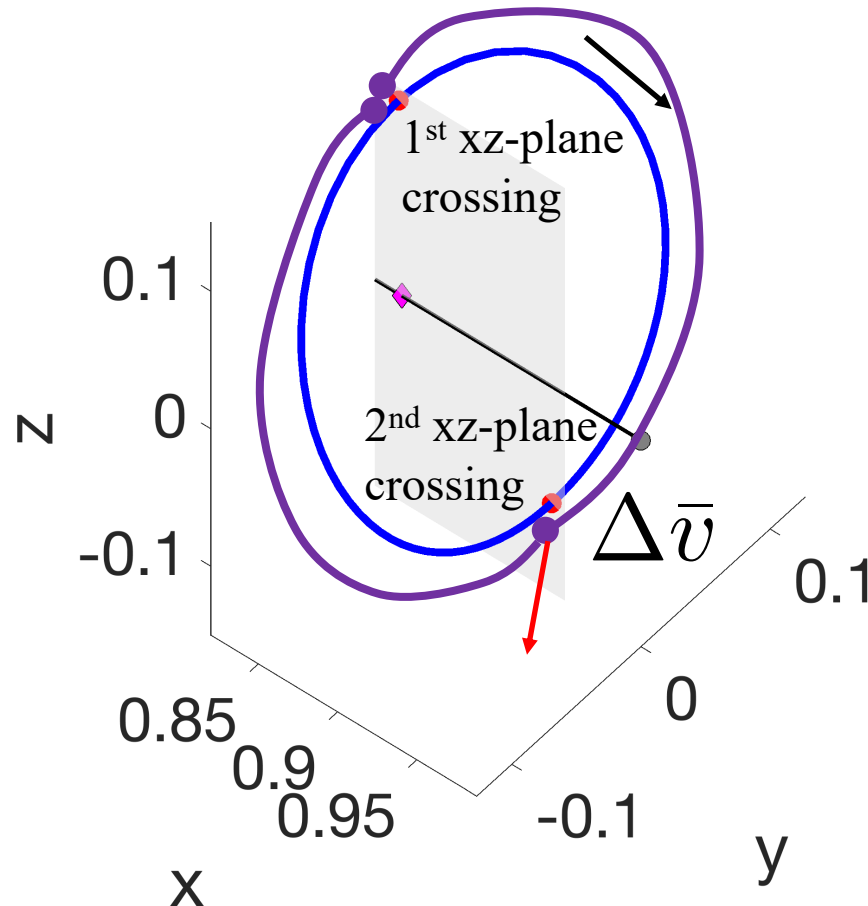
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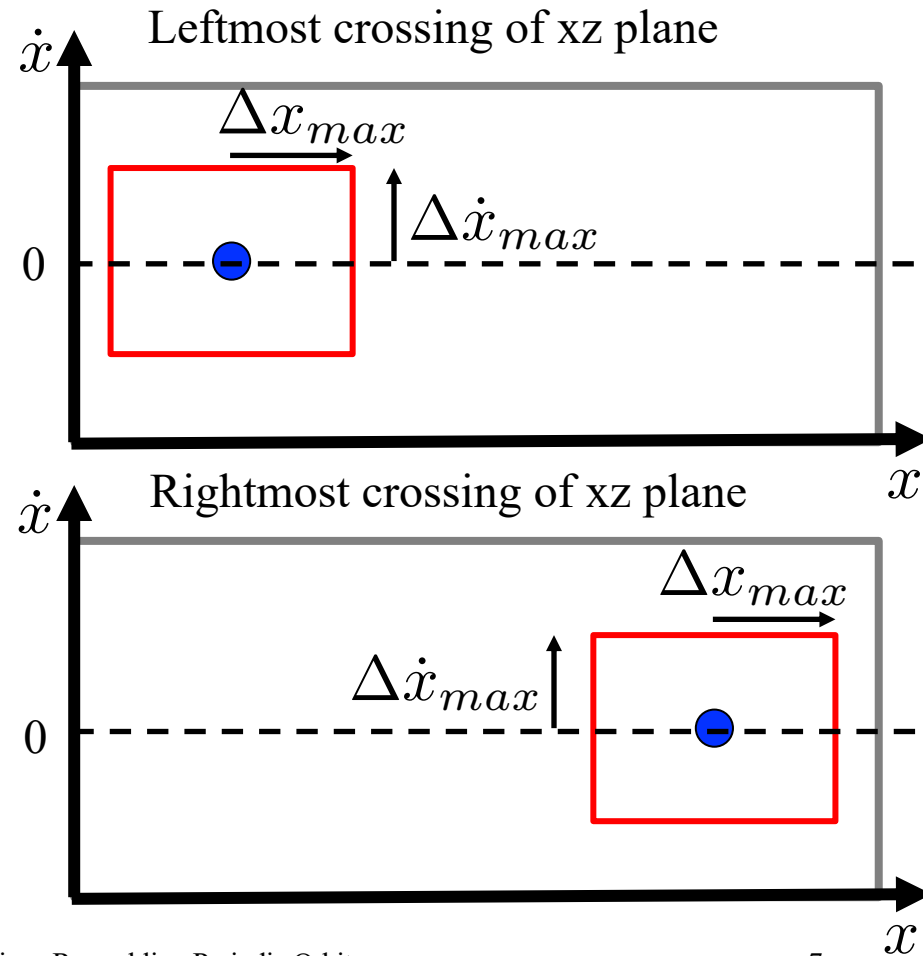
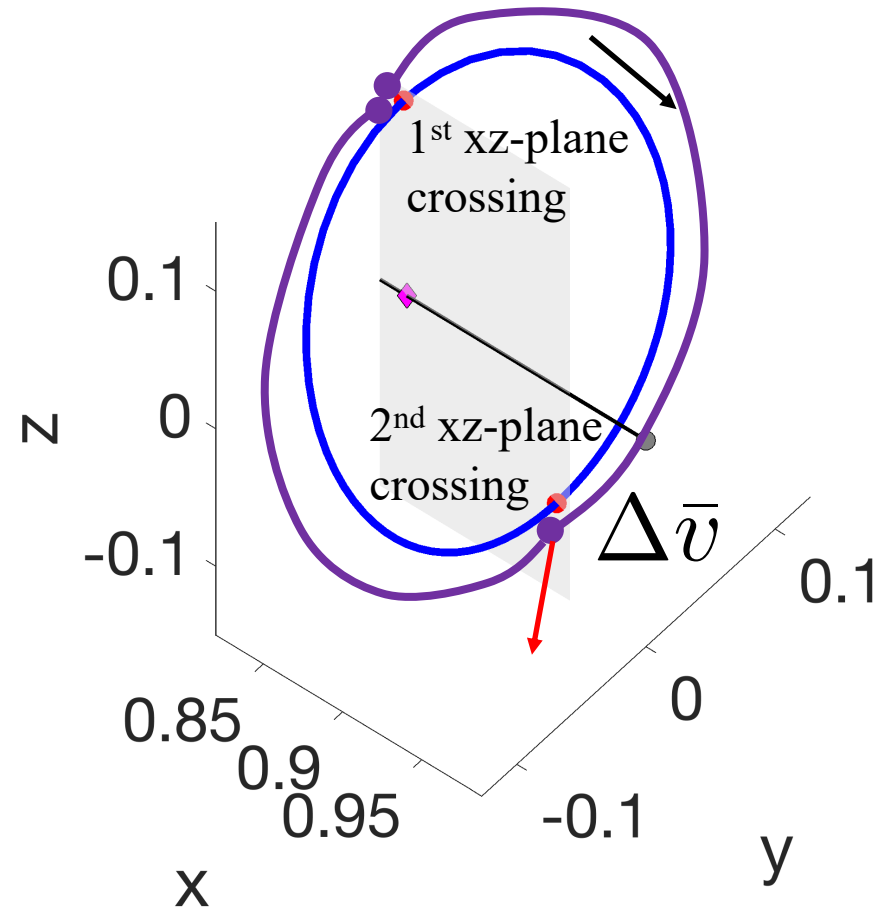
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# Motions Resembling Periodic Orbits

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# *Overview of Approach*

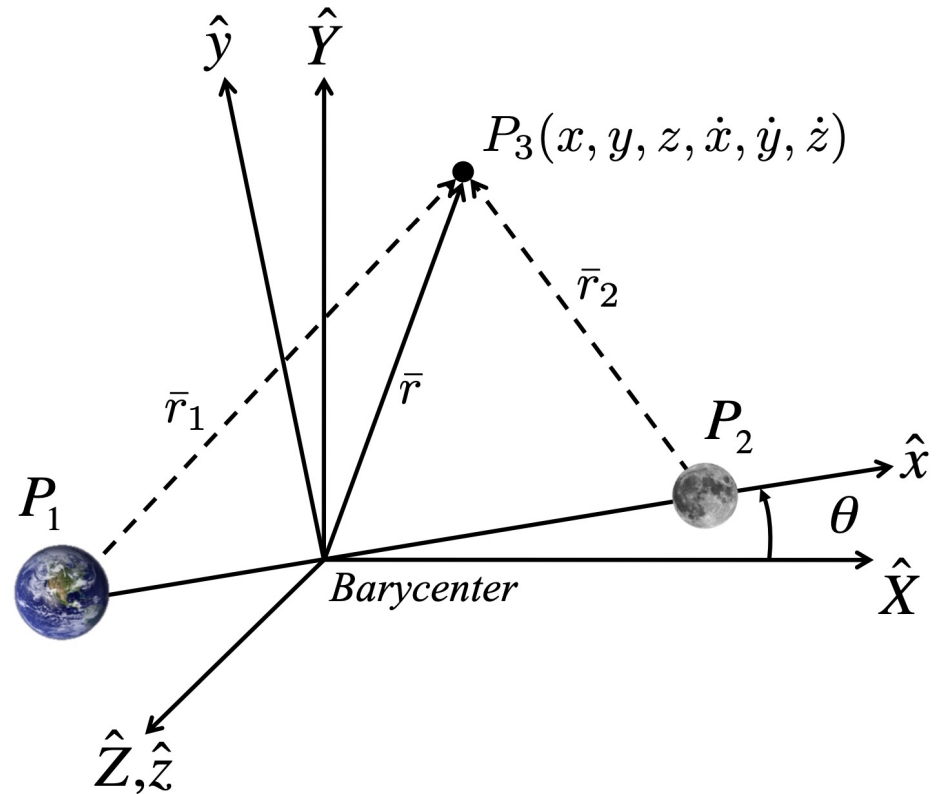
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1. Specify an initial guess for a state vector in Earth-Moon rotating frame that lies on the xz-plane
2. Propagate the path forward for approximately 1/2 a revolution until the next xz-plane crossing
3. Adjust the initial condition until the subsequent xz plane crossing possesses state components with a specified tolerance of the associated state along the periodic orbit
4. Allow a maneuver to be performed at this xz-plane crossing
5. Propagate the path forward for approximately 1/2 a revolution until the next xz-plane crossing
6. Adjust the maneuver components until the subsequent xz plane crossing possesses state components with a specified tolerance of the associated state along the periodic orbit



# Calculating an Initial Guess for State Vector

- Periodic orbits in the CR3BP produce state vectors at xz-plane crossing in nondimensional form
- Translate to use Moon as origin
- Dimensionalize by calculating instantaneously-calculated characteristic quantities
- Use as a guess for initial state vector



$$l^* = \tilde{R}_1 + \tilde{R}_2 \quad t^* = \left( \frac{(l^*)^3}{\tilde{G}m^*} \right)^{1/2}$$