Michigan Tech

UN5390: Scientific Computing I

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Simulation of Gravitational Slingshot on a HPC cluster

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Introduction

A gravitational slingshot, gravity assist maneuver, or swing-by is the use of the relative movement and the gravity of a planet or other astronomical object to alter the path and speed of a spacecraft, typically in order to save propellant, time, and expense. Gravity assistance can be used to accelerate a spacecraft, that is, to increase or decrease its speed and/or redirect its path. The 'assist" is provided by the motion of the gravitating body as it pulls on the spacecraft. e.g. The earth's gravity can be used to slingshot a satellite in a direction to reach a destination. It was used by interplanetary probes from Mariner 10 onwards, including the two Voyager probes' notable flybys of Jupiter and Saturn and in the Mars orbiter mission(MOM), 'Mangalyan", to reach planet mars by ISRO. [1] [2]

Description

Describe what you are going to do and how you are going to do it? This can be technical, and intended for someone in your area of research. Include any mathematics, graphics, and preliminary work that has already been done (either by you or someone else). No more than five references, and must not exceed three paragraphs with five-six sentences per paragraph.

It is a long established fact [3, 4] that a reader will be distracted by the readable content of a page when looking at its layout. The point of using Lorem Ipsum is that it has a more-or-less normal distribution of letters, as opposed to using *Content here, content here*, making it look like readable English. A search for *lorem ipsum* will uncover many web sites in their infancy. A search for *lorem ipsum* will uncover many web sites in their infancy.

$$\pi_{\text{newton}} = 2 \sum_{n=0}^{\infty} \frac{2^n \, (n!)^2}{(2n+1)!} \qquad \pi_{\text{madhava}} = \sqrt{12} \sum_{n=0}^{\infty} \frac{(-3)^{-n}}{2n+1} \tag{1}$$

References

[1] `https://en.wikipedia.org/wiki/Gravity_assist#cite_note-1`.

[2] `https://en.wikipedia.org/wiki/Mars_Orbiter_Mission`.

[3] N. Giordano and H. Nakanishi. *Computational Physics*. Pearson Prentice Hall, Upper Saddle River, NJ, USA, 2006.

[4] A. Einstein, B. Podolsky, and N. Rosen. Can Quantum-Mechanical Description of Physical Reality Be Considered Complete? *Phys. Rev. B*, 47:777, 1935.