

Project 1

The Flights of Spirit and Opportunity

The Mars exploration rovers (MERs) Spirit and Opportunity launched respectively on June 10, 2003, 1:58:47 p.m. EDT (Easter Daylight Time) and July 7, 2003, 11:18:15 p.m. EDT from launch pads 17-A and 17-B at the Cape Canaveral Air Force station in Cape Canaveral, Florida. They both landed successfully on Mars, Spirit at 11:35 p.m. EST (Eastern Standard Time) Jan. 3, 2004 and Opportunity at 12:05 a.m. EST Jan. 25, 2004. The goal of this project will be (ignoring the precise mechanics of exiting the earth's atmosphere or entering the Martian atmosphere) to use Newtonian mechanics and Newton's law of gravitation to develop a model of the trajectory of each of these rovers.

Assignments

- Develop three body problem involving Sun, Earth and Mars. Write M-file to simulate their motion with initial conditions given in the class.
- Construct a four-body problem involving the sun, Earth, Mars and one rover (ignoring effects of the Moon), and determine the velocity with which the rover exited the earth's atmosphere in order to strike Mars at the specified date. Design a MATLAB M-file that solves your system of equations and graphically depicts the time evolution of your system similarly as our M-file from class. Start three body system (Sun, Earth and Mars) with initial conditions from part 1. Launch the rover at day=27 and find the horizontal velocity of the rover that will guarantee that you land on Mars on day=207. Take the vertical velocity of the rover to be the same as Earth's vertical velocity. As for horizontal velocity, find it in the interval $[2e + 9 : 3e + 9]$.