

# Space Mission analysis software

Ali Ahmed Almorshdy  
BeniSuef, Egypt, aamaa.789456123@gmail.com

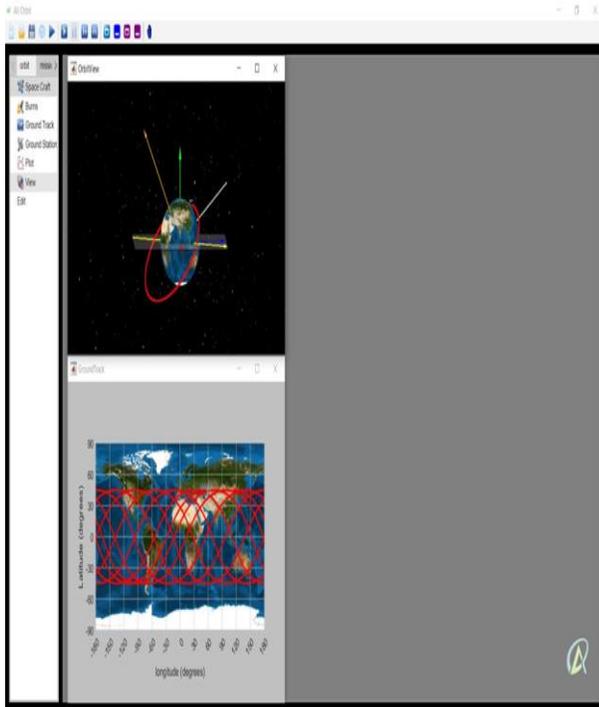
Supervisor: Navigation Science and space technology, Space Navigation

*Abstract—Space Mission analysis software using MATLAB code, program would show an animation of this orbit and results. and also draw the ground track of this orbit, you can also add a maneuver to this orbit and see its results and visualizations, the program can also predict, the time at which the satellite be in your location in the sky.*

## I. INTRODUCTION

Using programming with space is a must. There is no doubt that simulation is a good way for the student to understand the equations he is studying rather than just memorizing them. It is also possible through this program to save billions by simulating the space mission before its launch so I build this Program using MATLAB code.

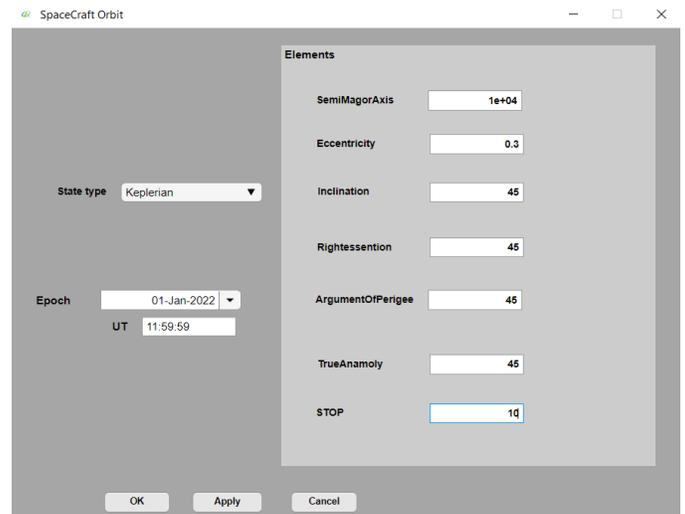
Keywords— Space – Simulations – missions– tracks– maneuvers–satellite



Program users' interface.

## II. usage

- User Data



here you type satellite data, you can choose state type like(cartesian-Keplerian-spherical) you may also add the epoch date which is the time and date corresponding to the specified orbit state so the program will calculate the sidereal time. and know the position of satellite relative to earth. You can also type the number of revaluation, add this the program will end its calculation.



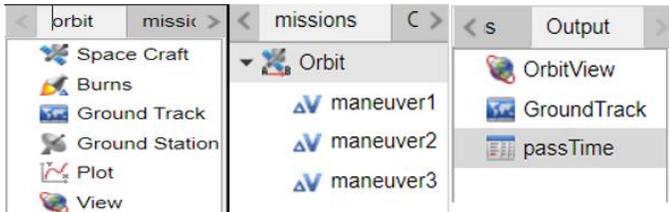
here you add your location "latitude and longitude" so the program can predict the time which satellite will be in your sky

### III. Outputs

#### Toolbar.

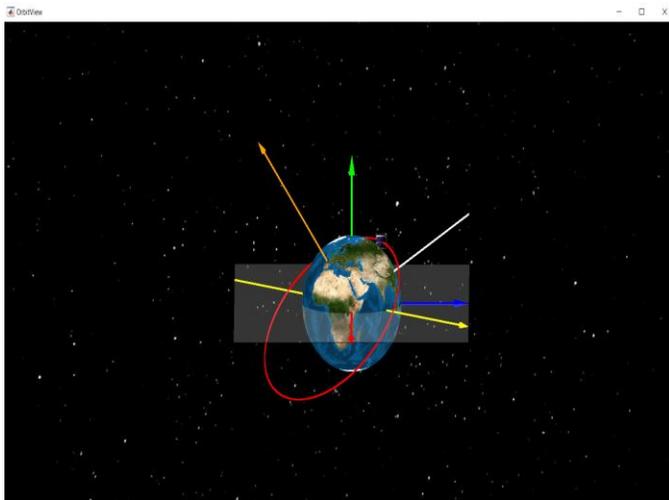


you can from the toolbar run your mission or from the animation button you can see the animation of the satellite, you can also from animation buttons to control the speed of motion. after you are done you can save your mission or upload a new mission.



From Tree Control you can navigate and display data you Edit, Views, You Can also display all Results

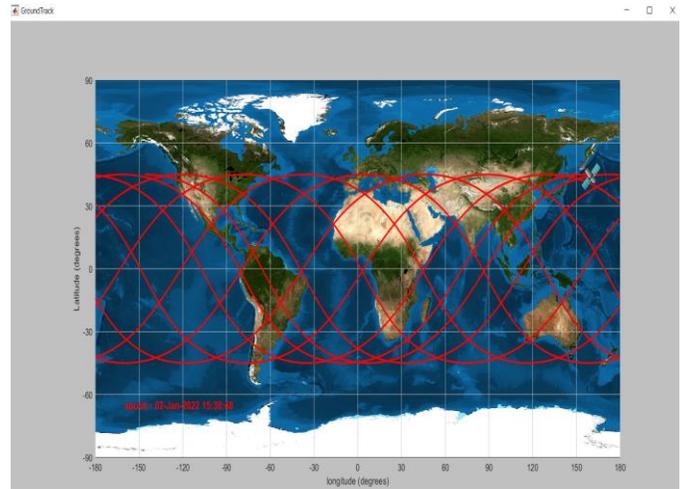
- **Orbit View**



The Orbit View allows you to plot trajectories of a spacecraft relative to earth. you can also run animation from this orbit so you can see the relative motion of this satellite to earth using buttons in the toolbar.

Blue Cube points to satellite location relative to earth "red, blue and green" arrow is an Earth-centered inertial (ECI) coordinate frame "yellow line" is a line of node, "Whit line" is an Apse line," Orange line" is an angular momentum line.

- **Ground tracks**



*Satellite Ground Track The ground track is the expression of the relative motion of the satellite in its orbit to the Earth's surface rotating beneath it. you can also From Toolbar Run animation of this track so you can see the motion of the satellite and its location on earth. you can slow down the animation and therefore you can see the live track of this satellite.*

- **Predict Pass Time**

PassTime

```
*****pass time*****
```

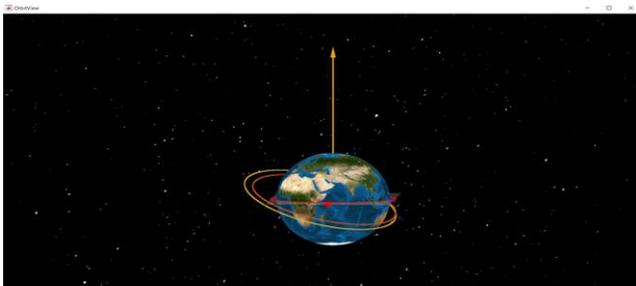
Start(UTC)	End(UTC)	Duration (s)
01-Jan-2022 19:58:58	01-Jan-2022 20:11:08	729.998977
01-Jan-2022 22:54:58	01-Jan-2022 23:08:48	829.998837
02-Jan-2022 01:48:38	02-Jan-2022 02:19:48	1869.997381
02-Jan-2022 04:41:38	02-Jan-2022 05:31:18	2979.995826
02-Jan-2022 07:42:18	02-Jan-2022 08:23:08	2449.996568
02-Jan-2022 18:01:58	02-Jan-2022 18:10:48	529.999258
02-Jan-2022 20:54:58	02-Jan-2022 21:06:58	719.998991
02-Jan-2022 23:50:48	03-Jan-2022 00:08:18	1049.998529
03-Jan-2022 02:43:28	03-Jan-2022 03:22:08	2319.996750
03-Jan-2022 05:37:38	03-Jan-2022 06:28:08	3029.995756
03-Jan-2022 18:55:38	03-Jan-2022 19:07:38	719.998991
03-Jan-2022 21:51:18	03-Jan-2022 22:03:18	719.998991
04-Jan-2022 00:45:58	04-Jan-2022 01:09:48	1429.997997
04-Jan-2022 03:38:38	04-Jan-2022 04:22:48	2649.996288
04-Jan-2022 06:35:28	04-Jan-2022 07:21:28	2759.996134
04-Jan-2022 17:00:08	04-Jan-2022 17:04:38	269.999622
04-Jan-2022 19:50:58	04-Jan-2022 20:03:28	749.998949
04-Jan-2022 22:47:38	04-Jan-2022 23:01:08	809.998865
05-Jan-2022 01:40:58	05-Jan-2022 02:12:08	1869.997381
05-Jan-2022 04:34:08	05-Jan-2022 05:21:18	2829.996036
05-Jan-2022 07:38:28	05-Jan-2022 08:07:28	1739.997563
05-Jan-2022 17:52:28	05-Jan-2022 18:03:58	689.999034
05-Jan-2022 20:47:28	05-Jan-2022 20:59:08	699.999020
05-Jan-2022 23:43:18	06-Jan-2022 00:00:58	1059.998515
06-Jan-2022 02:35:48	06-Jan-2022 03:13:38	2269.996820
06-Jan-2022 05:30:28	06-Jan-2022 06:16:58	2789.996092
06-Jan-2022 18:47:08	06-Jan-2022 19:00:08	779.998907
06-Jan-2022 21:44:08	06-Jan-2022 21:55:38	689.999034
07-Jan-2022 00:38:18	07-Jan-2022 01:02:28	1449.997969
07-Jan-2022 03:30:58	07-Jan-2022 04:13:28	2549.996428

*Depending on your location and satellite data, the program can predict the time at which this satellite be in your sky Taking into account the presence of perturbation like drag and oblate spheroid and Solar Wind so it can display a Hight prediction*

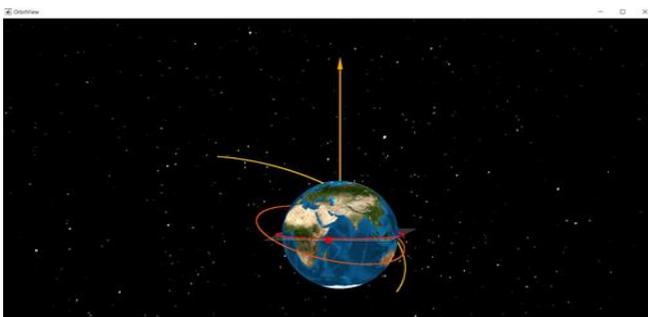
• **Maneuvers**



In spaceflight, an orbital maneuver (otherwise known as a burn) is the use of propulsion systems to change the orbit of a spacecraft. You can add it in satellite velocity direction or in normal or in binormal. So you can do it in same Orbit plan or Change Orbit plan.



Change Orbit plan by adding more velocity to binormal plan.



Change Orbit type to escape trajectory by adding more burns to binormal plan so you can here see a visualization of escape trajectories.

• **Results**

```

Results
*****Orbital Results*****

1-Keplerian Elements:
-----
1-Semi Majoraxis = 7000.000000 km
2-eccentricity = 0.000000
3-Inclination = 0.000000°
4-Rightessention = 0.000000°
5-Argument Of Perigee = 0.000000°
6-Mean Anomaly = 495.000000°
7-Eccentric Anomaly = 495.000000°
8-True Anomaly = 135.000000°

2-State Vectot:
-----
1-X1= -4949.747468 km      X2= -4949.629166 km
2-Y1= 4949.747468 km      Y2= 4949.865768 km
3-Z1= 0.000000 km        ZZ= 0.000000 km
4-VX1= -5.335871 km/S    VX2= -5.335998 km/S
5-VY1= -5.335871 km/S    VY2= -5.335743 km/S
6-VZ1= -0.000000 km/S    VZ2= 0.000000 km/S

2-Other Orbit Data:
-----
Semi minor Axis = 7000.000000 km
specific angular momentum = 52822.423269 KM^2/S
Orbit Energy = -28.471514 km^2/S^2
Mean motion = 0.001078 RAD/S
Periapsis = 7000.000000 km
VelPeriapsis = 7.546060 km/S
Apoapsis = 7000.000000 km
VelApoapsis = 7.546060 km/S
Orbit Period = 5828.511094 S
    
```

you can here see results of orbit at the end of date of tracking this satellite, you will see different data like Keplerian and cartesian or Spherical elements so it can help student in his studies, it also can show all results for each orbit after maneuvers.

**REFERENCES**

- [1] -orbital mechanics for engineering students.
- [2] -fundamentals of astrodynamics [Applications]
- [3] -MATLAB programming and solving equations using ode45.