

MATLAB CODE FOR CELESTIAL BODY PROPERTIES

% All values are in SI units.

% RGB color vectors are on a normalized 0-1 scale.

% Body dimensions are scaled for visualization purposes.

% Scaling has no impact on model dynamics.

% Scaling

SunScaling = 0.5e2;

TerrestrialPlanetScaling = 1.2e3;

GasGiantScaling = 2.5e2;

% Sun

Sun.M = 1.99e30;

Sun.R = 6.96e8*SunScaling;

Sun.RGB = [1 0.5 0];

% Mercury

Mercury.M = 3.30e23;

Mercury.R = 2.44e6*TerrestrialPlanetScaling;

Mercury.RGB = [0.5 0.5 0.5];

% Venus

Venus.M = 4.87e24;

Venus.R = 6.05e6*TerrestrialPlanetScaling;

Venus.RGB = [1 0.9 0];

% Earth

Earth.M = 5.97e24;

Earth.R = 6.05e6*TerrestrialPlanetScaling;

Earth.RGB = [0.3 0.6 0.8];

% Mars

Mars.M = 6.42e23;

Mars.R = 3.39e6*TerrestrialPlanetScaling;

Mars.RGB = [0.6 0.2 0.4];

% Jupiter

Jupiter.M = 1.90e27;

```
Jupiter.R = 6.99e7*GasGiantScaling;  
Jupiter.RGB = [0.6 0 0.3];
```

```
% Saturn
```

```
Saturn.M = 5.68e26;  
Saturn.R = 5.82e7*GasGiantScaling;  
Saturn.RGB = [1 1 0];
```

```
% Uranus
```

```
Uranus.M = 8.68e25;  
Uranus.R = 2.54e7*GasGiantScaling;  
Uranus.RGB = [0.3 0.8 0.8];
```

```
% Neptune
```

```
Neptune.M = 1.02e26;  
Neptune.R = 2.46e7*GasGiantScaling;  
Neptune.RGB = [0.1 0.7 0.8];
```

MATLAB CODE TO INSERT INITIAL STATE TARGETS

```
SunScaling = 0.5e2;  
TerrestrialPlanetScaling = 1.2e3;  
GasGiantScaling = 2.5e2;  
% Sun  
Sun.M = 1.99e30;  
Sun.R = 6.96e8*SunScaling;  
Sun.RGB = [1 0.5 0];  
Sun.Px = 5.5850e+08;  
Sun.Py = 5.5850e+08;  
Sun.Pz = 5.5850e+08;  
Sun.Vx = -1.4663;  
Sun.Vy = 11.1238;  
Sun.Vz = 4.8370;  
% Mercury  
Mercury.M = 3.30e23;  
Mercury.R = 2.44e6*TerrestrialPlanetScaling;  
Mercury.RGB = [0.5 0.5 0.5];  
Mercury.Px = 5.1979e+10;
```

Mercury.Py = 7.6928e+09;
Mercury.Pz = -1.2845e+09;
Mercury.Vx = -1.5205e+04;
Mercury.Vy = 4.4189e+04;
Mercury.Vz = 2.5180e+04;

% Venus

Venus.M = 4.87e24;
Venus.R = 6.05e6*TerrestrialPlanetScaling;
Venus.RGB = [1 0.9 0];
Venus.Px = -1.5041e+10;
Venus.Py = 9.7080e+10;
Venus.Pz = 4.4635e+10;
Venus.Vx = -3.4770e+04;
Venus.Vy = -5.5933e+03;
Venus.Vz = -316.8994;

% Earth

Earth.M = 5.97e24;
Earth.R = 6.05e6*TerrestrialPlanetScaling;
Earth.RGB = [0.3 0.6 0.8];
Earth.Px = -1.1506e+09;
Earth.Py = -1.3910e+11;
Earth.Pz = -6.0330e+10;
Earth.Vx = 2.9288e+04;
Earth.Vy = -398.5759;
Earth.Vz = -172.5873;

% Mars

Mars.M = 6.42e23;
Mars.R = 3.39e6*TerrestrialPlanetScaling;
Mars.RGB = [0.6 0.2 0.4];
Mars.Px = -4.8883e+10;
Mars.Py = -1.9686e+11;
Mars.Pz = -8.8994e+10;
Mars.Vx = 2.4533e+04;
Mars.Vy = -2.7622e+03;
Mars.Vz = -1.9295e+03;

% Jupiter

Jupiter.M = 1.90e27;

Jupiter.R = 6.99e7*GasGiantScaling;

Jupiter.RGB = [0.6 0 0.3];

Jupiter.Px = -8.1142e+11;

Jupiter.Py = 4.5462e+10;

Jupiter.Pz = 3.9229e+10;

Jupiter.Vx = -1.0724e+03;

Jupiter.Vy = -1.1422e+04;

Jupiter.Vz = -4.8696e+03;

% Saturn

Saturn.M = 5.68e26;

Saturn.R = 5.82e7*GasGiantScaling;

Saturn.RGB = [1 1 0];

Saturn.Px = -4.2780e+11;

Saturn.Py = -1.3353e+12;

Saturn.Pz = -5.3311e+11;

Saturn.Vx = 8.7288e+03;

Saturn.Vy = -2.4369e+03;

Saturn.Vz = -1.3824e+03;

% Uranus

Uranus.M = 8.68e25;

Uranus.R = 2.54e7*GasGiantScaling;

Uranus.RGB = [0.3 0.8 0.8];

Uranus.Px = 2.7878e+12;

Uranus.Py = 9.9509e+11;

Uranus.Pz = 3.9639e+08;

Uranus.Vx = -2.4913e+03;

Uranus.Vy = 5.5197e+03;

Uranus.Vz = 2.4527e+03;

% Neptune

Neptune.M = 1.02e26;

Neptune.R = 2.46e7*GasGiantScaling;

```
Neptune.RGB = [0.1 0.7 0.8];  
Neptune.Px = 4.2097e+12;  
Neptune.Py = -1.3834e+12;  
Neptune.Pz = -6.7105e+11;  
Neptune.Vx = 1.8271e+03;  
Neptune.Vy = 4.7731e+03;  
Neptune.Vz = 1.9082e+03;
```

MATLAB CODE TO SIMULATE REAL TIME DATA

%Implement the position of the Earth with respect to the Barycentre of solar system for Nov 1st, 2017:

```
position = planetEphemeris(juliandate(2017,11,1), 'solarSystem', 'Earth')
```

output:

```
position =
```

```
1.0e+08 *
```

```
1.1650 0.8564 0.3710
```

%position and velocity of earth with respect to barycentre of Solar System.

```
[position,velocity]=planetEphemeris(juliandate(2017,11,1), 'solarSystem', 'Earth')
```

```
position =
```

```
1.0e+08 *
```

```
1.1650 0.8564 0.3710
```

```
velocity =
```

```
-19.0436 21.2804 9.2264
```