5.2

Slade Brooks
M13801712
HW#8
11.06.24

Contents

Initialize

```
clear; clc;
```

Define variables and constants

```
global mu
mu = 398600;        % km^3/s^2
```

Initial conditions

```
r1 = [5887 -3520 -1204];        % km
r2 = [5572 -3457 -2376];        % km
r3 = [5088 -3289 -3480];        % km
```

Use gibbs script from textbook to find v2

```
[v2, ierr] = gibbs(r1, r2, r3);
```

get orbital params from coe from sv script from book

```
coe = coe_from_sv(r2, v2, mu);

% outputs
% coe = [h e RA incl w TA a]
fprintf("e=%g", coe(2));
fprintf("\nh=%g km^2/s", coe(1));
fprintf("\ni=%g deg", rad2deg(coe(4)));
fprintf("\nOmega=%g deg", rad2deg(coe(3)));
fprintf("\nw=%g deg", rad2deg(coe(5)));
fprintf("\ntheta=%g deg", rad2deg(coe(6)));
```

```
e=0.0127385
h=52948.9 km^2/s
i=95.0071 deg
Omega=150.003 deg
w=151.691 deg
theta=48.3059 deg
```

calculate perigee

```
rp = coe(1)^2/mu*1/(1+coe(2));       % radius of perigee (km)
zp = rp - 6378;                      % alt of perigee (km)
fprintf("\nz perigee=%g km", zp);
```

```
z perigee=567.108 km
```

Published with MATLAB® R2021a

Contents

Initialize

```
clear; clc;
```

Problem 5.4

Define variables and constants

```
global mu
mu = 398600;        % km^3/s^2

% Initial conditions
r1 = [3600 4600 3600];          % km
r2 = [-5500 6240 -5200];        % km
dt = 30*60;                     % s
string = "pro";

% use lambert function (alogrithm 5.2) from book to get v at each position
[v1, v2] = lambert(r1, r2, dt, string);
```

calculate epsilon

get mangitude of v and r

```
v = norm(v1);
r = norm(r1);

% calculate and return epsilon
e = v^2/2 - mu/r;
fprintf("epsilon=%g km^2/s^2", e)
```

```
epsilon=-19.8706 km^2/s^2
```

Problem 5.5

calculate h

```
h1 = cross(r1, v1);
h = norm(h1);

% calc e
e = sqrt(1 + h^2/mu^2*(v^2 - 2*mu/r));
```

```
% then get r, z, and i
r = h^2/mu*1/(1 + e);
zp = r - 6378;
i = acosd(h1(3)/h);

% print results
fprintf("\nz perigee=%g km", zp);
fprintf("\ni=%g deg", i);
```

```
z perigee=473.589 km
i=44.168 deg
```

Published with MATLAB® R2021a

5.7

Contents

Initialize

```
clear; clc;
```

Define variables and constants

```
global mu
mu = 398600;        % km^3/s^2
```

Initial conditions

```
r1 = [5644 -2830 -4170];        % km
r2 = [-2240 7320 -4980];        % km
dt = 20*60;                     % s
string = "pro";
```

use lambert function from book to get v at each position

```
[v1, v2] = lambert(r1, r2, dt, string);
```

get orbital params from coe from sv script from book

```
coe = coe_from_sv(r1, v1, mu);

% outputs
% coe = [h e RA incl w TA a]
fprintf("e=%g", coe(2));
fprintf("\nh=%g km^2/s", coe(1));
fprintf("\ni=%g deg", rad2deg(coe(4)));
fprintf("\nOmega=%g deg", rad2deg(coe(3)));
fprintf("\nw=%g deg", rad2deg(coe(5)));
fprintf("\ntheta=%g deg", rad2deg(coe(6)));
```

```
e=1.20053
h=76096.4 km^2/s
i=59.0184 deg
Omega=130.007 deg
w=259.98 deg
theta=320.023 deg
```

calculate perigee

```
rp = coe(1)^2/mu*1/(1+coe(2));       % radius of perigee (km)
zp = rp - 6378;                      % alt of perigee (km)
fprintf("\nz perigee=%g km", zp);
```

```
z perigee=223.823 km
```

Published with MATLAB® R2021a