

NumericalPropagationWithContinuousManeuver 4.1

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```
public class NumericalPropagationWithContinuousManeuver {

    public static void main(String[] args) throws PatriusException {

        // Patrius Dataset initialization (needed for example to get the UTC
time)
        PatriusDataset.addResourcesFromPatriusDataset() ;

        // Recovery of the UTC time scale using a "factory" (not to duplicate
such unique object)
        final TimeScale TUC = TimeScalesFactory.getUTC();

        // Date of the orbit given in UTC time scale)
        final AbsoluteDate date = new AbsoluteDate("2010-01-01T12:00:00.000",
TUC);

        // Getting the frame with wich will defined the orbit parameters
// As for time scale, we will use also a "factory".
        final Frame GCRF = FramesFactory.getGCRF();

        // Initial orbit
        final double sma = 7200.e+3;
        final double exc = 0.01;
        final double per = sma*(1.-exc);
        final double apo = sma*(1.+exc);
        final double inc = FastMath.toRadians(98.);
        final double pa = FastMath.toRadians(0.);
        final double raan = FastMath.toRadians(0.);
        final double anm = FastMath.toRadians(0.);
        final double MU = Constants.WGS84_EARTH_MU;

        final ApsisRadiusParameters par = new ApsisRadiusParameters(per, apo,
inc, pa, raan, anm, PositionAngle.MEAN, MU);
        final Orbit iniOrbit = new ApsisOrbit(par, GCRF, date);

//SPECIFIC
        // Creating a mass model (see also specific example)
        final AssemblyBuilder builder = new AssemblyBuilder();

        // Main part
        final double iniMass = 900.;
        builder.addMainPart("MAIN");
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builder.addProperty(new MassProperty(iniMass), "MAIN");

// Tank part (ergols mass)
final double ergolsMass = 100.;
final TankProperty tank = new TankProperty(ergolsMass);
builder.addPart("TANK", "MAIN", Transform.IDENTITY);
builder.addProperty(tank, "TANK");

// Engine part
final double isp = 300.;
final double thrust = 400.;
final PropulsiveProperty prop = new PropulsiveProperty(thrust, isp);
builder.addPart("PROP", "MAIN", Transform.IDENTITY);
builder.addProperty(prop, "PROP");

final Assembly assembly = builder.returnAssembly();
final MassProvider mm = new MassModel(assembly);

// We create a spacecraftstate
final SpacecraftState iniState = new SpacecraftState(iniOrbit, mm);
//SPECIFIC

// Initialization of the Runge Kutta integrator with a 2 s step
final double pasRk = 2.;
final FirstOrderIntegrator integrator = new
ClassicalRungeKuttaIntegrator(pasRk);

// Initialization of the propagator
final NumericalPropagator propagator = new
NumericalPropagator(integrator);
propagator.resetInitialState(iniState);

// Forcing integration using cartesian equations
propagator.setOrbitType(OrbitType.CARTESIAN);

//SPECIFIC
// Duration of the maneuver to get a 20 m/S boost
final double G0 = 9.80665;
final double duration = G0*isp*iniMass*(1. -
FastMath.exp(-20/(G0*isp)))/thrust;
// Start and end thrust events
final EventDetector eventStart = new
DateDetector(date.shiftedBy(10.));
final EventDetector eventEnd = new
DateDetector(date.shiftedBy(10.+duration));
// Creation of the continuous thrust maneuver
final Vector3D direction = new Vector3D(1., 0., 0.);
final ContinuousThrustManeuver man = new
ContinuousThrustManeuver(eventStart, eventEnd, prop, direction, mm, tank);
// Adding a continuous thrust maneuver
propagator.addForceModel(man);

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// Adding additional state (change name add to set for V3.3)
propagator.setMassProviderEquation(mm);

// Adding an attitude law (or attitude sequence : mandatory)
final AttitudeLaw attitudeLaw = new LofOffset(LOFType.TNW,
RotationOrder.ZYX, 0., 0., 0.);
propagator.setAttitudeProvider(attitudeLaw);

//SPECIFIC

// Propagating 100s
final double dt = 100.;
final AbsoluteDate finalDate = date.shiftedBy(dt);
final SpacecraftState finalState = propagator.propagate(finalDate);
final Orbit finalOrbit = finalState.getOrbit();

// Printing new date and semi major axis
System.out.println();
System.out.println("Initial semi major axis =
"+iniOrbit.getA()/1000.+ " km");
System.out.println("New date = "+finalOrbit.getDate().toString(TUC)+
deg");
System.out.println("Final semi major axis =
"+finalOrbit.getA()/1000.+ " km");
// Printing mass
System.out.println();
System.out.println("Dry Mass = "+finalState.getMass("MAIN")+ " kg");
System.out.println("Ergols Mass = "+finalState.getMass("TANK")+
kg");
}
}

```

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