

SequenceOfAttitudes 4.5.1

De Wiki

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```
public class SequenceOfAttitudeLaws {

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

        // 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 iniDate = 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 inc = FastMath.toRadians(98.);
        final double pa = FastMath.toRadians(0.);
        final double raan = FastMath.toRadians(90.);
        final double anm = FastMath.toRadians(0.);
        final double MU = Constants.WGS84_EARTH_MU;

        final KeplerianParameters par = new KeplerianParameters(sma, exc,
inc, pa, raan, anm, PositionAngle.MEAN, MU);
        final Orbit iniOrbit = new KeplerianOrbit(par, GCRF, iniDate);

        // Using the Meeus model for the Sun.
        final CelestialBody sun = new MeeusSun();
        final double sunRadius = Constants.SUN_RADIUS;

        // Definition of the Earth ellipsoid for later atmospheric density
computation
        final Frame ITRF = FramesFactory.getITRF();
        final double earthRadius = Constants.WGS84_EARTH_EQUATORIAL_RADIUS;
        final GeometricBodyShape earth = new
ExtendedOneAxisEllipsoid(earthRadius, Constants.WGS84_EARTH_FLATTENING, ITRF,
```

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"EARTH");

    // Initializing attitude sequence
    final AttitudesSequence seqAtt = new AttitudesSequence();

    // Building a first attitude law (Sun pointing)
    final Vector3D firstAxis = new Vector3D(1., 0., 0.);
    final Vector3D secondAxis = new Vector3D(0., 1., 0.);
    final AttitudeLaw sunPointingLaw = new SunPointing(sun, firstAxis,
secondAxis, sun);

    // Building a second attitude law (LVLH)
    final AttitudeLaw lvlhLaw = new LofOffset(LOFType.LVLH);

    // Events that will switch from a law to another
    final double maxCheck = 10.;
    final double threshold = 1.e-3;
    final EventDetector eventEntryEclipse = new EclipseDetector(sun,
sunRadius, earth, earthRadius, 0,
        maxCheck, threshold, Action.RESET_STATE, Action.RESET_STATE);
    final EventDetector eventExitEclipse = new EclipseDetector(sun,
sunRadius, earth, earthRadius, 0,
        maxCheck, threshold, Action.RESET_STATE, Action.RESET_STATE);

    //Adding switches
    seqAtt.addSwitchingCondition(lvlhLaw, eventEntryEclipse, true, false,
sunPointingLaw);
    seqAtt.addSwitchingCondition(sunPointingLaw, eventExitEclipse, false,
true, lvlhLaw);

    testByPropagation(iniOrbit, seqAtt, sun);

}

public static void testByPropagation ( final Orbit iniOrbit, final
AttitudesSequence seqAtt, final CelestialBody sun ) throws PatriusException {

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

    // 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

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propagator.setOrbitType(OrbitType.CARTESIAN);

// Adding the attitude sequence
propagator.setAttitudeProvider(seqAtt);
seqAtt.registerSwitchEvents(propagator);

// Loop every 10 mn ...
final double step = 600.;
final double epsilon = 1.e-12;
for (int i = 1; i <= 20; i++) {

    AbsoluteDate date = iniOrbit.getDate().shiftedBy(i*step);

    final SpacecraftState state = propagator.propagate(date);

    // Attitude in LVLH
    final Attitude attLVLH = state.getAttitude(LOFType.LVLH);
    final double psiLVLH =
attLVLH.getRotation().getAngles(RotationOrder.ZYX)[0];
    final double tetaLVLH =
attLVLH.getRotation().getAngles(RotationOrder.ZYX)[1];

    // Attitude in GCRF
    final Attitude attGCRF = state.getAttitude();
    final double psiGCRF =
attGCRF.getRotation().getAngles(RotationOrder.ZYX)[0];
    final double tetaGCRF =
attGCRF.getRotation().getAngles(RotationOrder.ZYX)[1];

    // Direction of the Sun from the cdg of the satellite
    final Vector3D sunPos = sun.getPVCoordinates(date,
FramesFactory.getGCRF()).getPosition();
    final Vector3D satPos = state.getPVCoordinates().getPosition();
    final Rotation sunDir = new Rotation(Vector3D.PLUS_I,
sunPos.subtract(satPos));

    // Sun direction
    final double psiSun = sunDir.getAngles(RotationOrder.ZYX)[0];
    final double tetaSun = sunDir.getAngles(RotationOrder.ZYX)[1];

    if ( (FastMath.abs(psiLVLH) < epsilon) || (FastMath.abs(tetaLVLH)
< epsilon) ) {
        System.out.println(date+" => LVLH mode");
    } else {
        System.out.println(date+" => Sun pointing mode");
        System.out.println("    Delta Psi =
"+FastMath.toDegrees(psiSun-psiGCRF)+" deg");
        System.out.println("    Delta Teta =
"+FastMath.toDegrees(tetaSun-tetaGCRF)+" deg");
    }
}

```

}

}

}

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