# TwoDirectionsAttitudeLaw

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```
public class TwoDirectionsAttitudeLaw {

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

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

        // Sun directions
        ToCelestialBodyCenterDirection dirSun = new ToCelestialBodyCenterDirection(sun);
        CelestialBodyPolesAxisDirection dirPole = new CelestialBodyPolesAxisDirection(sun);

        // Building an attitude law
        final Vector3D firstAxis = new Vector3D(1., 0., 0.);
```

```
        final Vector3D secondAxis = new Vector3D(0., 1., 0.);
        final TwoDirectionAttitudeLaw attitudeLaw = new 
TwoDirectionAttitudeLaw(dirSun, dirPole, firstAxis, secondAxis);
        final Attitude att = attitudeLaw.getAttitude(iniOrbit);

        // Printing attitude
        final double psi  = 
att.getRotation().getAngles(RotationOrder.ZYX)[0];
        final double teta = 
att.getRotation().getAngles(RotationOrder.ZYX)[1];

        System.out.println("Psi  / GCRF  = "+FastMath.toDegrees(psi)+" deg");
        System.out.println("Teta / GCRF = "+FastMath.toDegrees(teta)+" deg");

        // Coordinates of the Sun vs GCRF at the same date
        PVCoordinates pv = sun.getPVCoordinates(date, GCRF);
        final Vector3D sunPos = pv.getPosition();

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

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

        System.out.println();
        System.out.println("Psi  / GCRF  = "+FastMath.toDegrees(psiSun)+" 
deg");
        System.out.println("Teta / GCRF = "+FastMath.toDegrees(tetaSun)+" 
deg");

        System.out.println();
        System.out.println("Delta Psi  = "+FastMath.toDegrees(psiSun-psi)+" 
deg");
        System.out.println("Delta Teta = "+FastMath.toDegrees(tetaSun-teta)+" 
deg");

    }

}
```

Récupérée de « http://patrius.cnes.fr/index.php?title=TwoDirectionsAttitudeLaw&oldid=3321 »

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