20/11/15

Lecture *Foundations of Satellite Geodesy* WS 2015/16 20. November 2015

3. Exercise: Ceres Problem

A fictious satellit *Stuttgart 1* is equipped wit an GPS receiver. A reference receiver is located at the GRS80 coordinates (L, B, H):

$$L = 9°.16, \quad B = 48°.75, \quad H = 300m$$

From the observations of both receivers the coordinate differences $d(t_i), i = 0, \ldots, n$ between the satellite and the reference station are derived. The coordinate differences refer to WGS84.

Additionally, the following informations are given:

- GAST (Greenwich Astronomical Sideral Time) at the first epoch.
- approximate values for the Keplerian elements.

Due to an unexplained miracle, the given values for e and ω are exact!
Assuming an undisturbed Keplerian motion, determine the exact values of the Keplerian elements

Use the following GRS80 parameters:

- $a = 6378137m$
- $e^2 = 6.943800229 \cdot 10^{-3}$
- $GM = 3.986005 \cdot 10^{14} m^3 s^{-2}$
- $\omega = 7.292115 \cdot 10^{-5} s^{-1}$

Hints

- The elements i, Ω can be determined by purely geometrical considerations.
- After that the parameters $a, M(t_0)$ have to be determined by adjustment.

Step 1 $\underset{\sim}{X}(t)$ ... WGS 84 (we need satellite position)

Step 2 Transformato $\underset{\sim}{X}(t)$ in ICRS.