Master-level Course in ”Satellite geodesy”.

Purpose: The course aims at developing an understanding of the application of satellites for positioning on the Earth and in space as well the modelling of the gravity field of the Earth. The description of geodetic coordinate systems, the theory of satellite orbits and of signal propagation form the basic part of the course.

Content: The course starts with a description of the geodetic coordinate-systems and the theory behind the determination of satellite orbits, especially the theory of perturbed Kepler-orbits. Signal-propagation of electromagnetic waves in the ionosphere and the troposphere is treated. The applied methods for position determination using satellites or quasars are described. Emphasis is put on the application of Global Navigation Satellite Systems, especially GPS. The application of radar technique for the determination of especially surfaces covered with ice or water is described. Methods for the determination of the Earth’s gravity field from perturbations of Kepler orbits and from measurements in and between satellites are treated (CHAMP, GOCE, GRACE).

Teaching goals:

The course aims at giving the participants methods and tools so that they may

1. explain the relationship between the knowledge of the gravity field and the determination of satellite orbits.
2. compute Kepler-elements from position and velocity considering linear time-variations of the elements.
3. compute changes in position as a function of change of coordinate-system and change in time.
4. compute changes of observed distances or directions due to refraction as well as the influence of non-gravitational forces on the satellite orbit.
5. use the least-squares method for position determination base don distance measurements.
6. explain why and how Doppler and distance observations may be used for position determination.
7. explain how a survey is planned and how GPS is used for position determination.
8. explain how distance determination from satellite or other radar measurements from satellite may be used for the determination of the height of the surface of the Earth or water-covered surfaces as well as their time-variations.
9. describe how satellite-orbits and measurements in and between satellites may be used for the determination of the gravity field of the Earth.

Requirements for obtaining ”12”: the grade is given for an excellent performance, demonstrating af fulfilment of 5 of the teaching goals, with no or few deficiencies.

C.C.Tscherning, (English version) 2007-10-23.