

# IP2: IMAGE PROCESSING IN REMOTE SENSING

## EXERCISE 1

**Due Date:** Mo. 26.05.2014, 8 am

**Scope:** Remote Sensing basics and satellite orbits

Please send your solutions via e-mail to: [germer@informatik.uni-hamburg.de](mailto:germer@informatik.uni-hamburg.de)

Use the subject "IP2-Ex1 GROUPNAME" and write your solutions

- Either as plain text or
- Convert them to PDF and attach the PDF to the mail.

### 1 REMOTE SENSING BASICS

6 P.

- Explain the differences between direct measurement, remote measurement and Remote Sensing
- Describe the main advantages of Remote Sensing with respect to the other measurement methods.
- Give some examples for applications by means of Remote Sensing Earth Observation.

### 2 GRAVITATIONAL ASTRONOMY

12 P.

To solve the following exercises use these values and assume a spherical shape of the Earth:

**Equatorial diameter:** 12765.32 km

**Rotation period:** 23h 56m 4,1s

**Geostationary orbit at:** 35786 km above the equator

- The mean solar day lasts nearly four minutes longer than the rotational period of the Earth. Explain the difference!
- The International Space Station (ISS) is positioned on a Low Earth Orbit (LEO) with a perigee of 319.6 km and an apogee of 346.9 km above the Earth's surface. Derive the following values:
  - The orbit's shape given as the semi-major  $a$ , the semi-minor  $b$  and the eccentricity  $e$ .
  - The orbital period  $T$  of the ISS.
  - Derive the velocities  $v_1$  and  $v_2$  of the ISS for the points of lowest and highest altitude above the Earth's surface.
- Determine the orbital period and the orbital velocity for a satellite, which is on an (obviously fictive) orbit right at the equator.

- d) Is it possible for a satellite to be on a geostationary orbit above Hamburg?
- e) Is it possible for a satellite to have an orbit, which follows the 30<sup>th</sup> latitude?
- f) Explain why sun-synchronous orbits are all polar crossing!
- g) What is the main advantage of a sun-synchronous orbit?
- h) Which orbit needs to be chosen, if a satellite shall stay longer over the northern hemisphere than over the southern hemisphere?
- i) Which orbits result in an eight-shaped ground track? Explain the reason for this shape!

**Total points: 30**