

AI1149 Geodata quality and time series analysis

1. General description

Geospatial data can be evaluated from different aspects, such as geographic coverage and resolution, data structure and formats (raster or vector data), coordinate systems used for georeferencing, and various quality aspects (precision, accuracy, reliability). Positions and coordinates are the most important information in geospatial databases. They are often derived from direct measurements of various kinds, such as measurements from a geodetic total station or a GNSS receiver. All measurements contain errors which in turn affect the derived quantities (e.g. coordinates) and create uncertainties in all derived geodata.

With new real-time surveying technologies such as GNSS, UAV, measurements are time-dependent and need to be processed in specific ways.

This course is about applications of statistical theories and numerical methods to:

1. evaluate the quality of measurements and derived quantities in terms of precision, accuracy and reliability,
2. eliminate misclosures (contradictions among measurements) caused by errors and
3. derive optimal estimates from available, error-contaminated measurements
4. analyze and process time-dependent measurements

2. Time schedule

The course consists of 10 lectures (L), 8 compulsory exercises (E) and the final written exam (TEN1).

Date	Day	Time	Room	L	E	Topics
2023-11-01	Wednesday	10-12	B21	<i>L1</i>		Introduction
2023-11-03	Friday	10-12	Bora Bora	<i>L2</i>		Error propagation
		13-17	Bora Bora		<i>E1</i>	Error propagation
2023-11-06	Monday	10-12	Bora Bora	<i>L3</i>		Distributions and hypothesis tests
2023-11-08	Wednesday	10-12	B24	<i>L4</i>		Variance analysis and regression analysis
		14-18	Bora Bora		<i>E2</i>	Statistical analysis
2023-11-15	Wednesday	10-12	Bora Bora	<i>L5</i>		Least squares adjustment in linear models
2023-11-16	Thursday	09-12	Bora Bora		<i>E3</i>	Least squares adjustment in linear models
2023-11-20	Monday	10-12	B25	<i>L6</i>		Non-linear observation equations
		13-17	B24		<i>E4</i>	Non-linear observation equations
2023-11-28	Tuesday	15-17	Bora Bora	<i>L7</i>		Local redundancy, reliability, data snooping
2023-11-29	Wednesday	13-17	Q11		<i>E5</i>	Local redundancies
2023-12-07	Thursday	10-12	L22	<i>L8</i>		Introduction. Discrete Fourier analysis
		13-17	L41		<i>E6</i>	Discrete Fourier analysis
2023-12-14	Thursday	10-12	Bora Bora	<i>L9</i>		Moving averaging and autoregressions
		13-17	Bora Bora		<i>E7</i>	Moving averaging and autoregression
2023-12-15	Friday	10-12	B26	<i>L10</i>		Dynamic systems and Kalman filtering
		13-17	B26		<i>E8</i>	Kalman filtering
2024-01-12	Friday	08-12	U61	<i>TN1</i>		Written examination

3. Course literature

The following materials will be used as course literature and distributed to students at the first lesson :

1. H Fan (2010). *Theory of errors and least squares adjustment*. (Selected pages marked by **X**)
2. H Fan (2023). *Geodata quality exercise problems*.