

## International Doctorate in Civil and Environmental Engineering

### DOCTORAL COURSE

# Introduction to least squares adjustment and statistical methods

Teacher: Prof. **Andrea Masiero**

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Calendar	
04/03/2020, 09,00-11,00 – Aula ?, Scuola di Ingegneria, Via di S. Marta 3, Firenze	Basics of statistics, estimation and statistical error characterization
11/03/2020, 09,00-11,00 – Aula ?, Scuola di Ingegneria, Via di S. Marta 3, Firenze	Linear algebra review, principal component analysis
18/03/2020, 09,00-11,00 – Aula ?, Scuola di Ingegneria, Via di S. Marta 3, Firenze	Mathematical modeling, estimation examples, error propagation
25/03/2020, 09,00-11,00 – Aula ?, Scuola di Ingegneria, Via di S. Marta 3, Firenze	Linear and conditional least squares adjustment
01/04/2020, 14,00-18,00 – Aula ?, Scuola di Ingegneria, Via di S. Marta 3, Firenze	Nonlinear optimization and nonlinear least squares adjustment
08/04/2020, 14,00-18,00 – Aula ?, Scuola di Ingegneria, Via di S. Marta 3, Firenze	Examples of LS adjustment: triangulation and trilateration. Monte Carlo methods and bootstrap
Total	16 hours – 8 credits

Program
This course provides an introduction to statistical error modelling, estimation theory, linear and nonlinear least squares adjustment, with a review of certain numerical and statistical methods related to the mentioned subjects. Topics that the course considers include: sources and types of measurement errors, basic hypothesis of error theory, review of basics of linear algebra and univariate/multivariate statistics, error propagation, linear least-squares adjustment, constrained least-squares adjustment, nonlinear least-squares adjustment, numerical methods and considerations, examples of least-squares adjustment (e.g. triangulation and trilateration), principal component analysis, introduction to Monte Carlo methods and bootstrap.