

DEVELOPMENTS IN GEOMATICS EDUCATION (6)

Geomatics at TU Delft

Collecting, processing, managing and distributing information and transforming it into relevant support for decision making constitutes the nerve system of society at local, regional, national and global scale. Of increasing importance is information bound to certain locations at, above or beneath the surface of the earth. The tools, techniques and theoretical background for acquiring, processing, managing and disseminating geo-information constitute the discipline of Geomatics.

TU Delft expertise in geomatics originates from a long tradition of education in Geodesy offered over fifty years at both BSc and MSc level until 2004. Since 2005 Geomatics at TU Delft has been offered as a two-year MSc-level programme only, covering acquisition, processing, management and application of geo-information. The programme arises from collaboration between three faculties at the university: Aerospace Engineering, where the portfolio includes acquisition and mathematical processing of geo-information, Technology, Policy and Management, where a GIS technology group specialises in computer processing and geo-information management, and Civil Engineering and Geosciences, covering a wide area of applications in which decision making relies on geo-information.

Technical Approach

The shift from BSc/MSc programme to MSc programme has been seized upon as an opportunity to rigorously revise the contents of the programme, not least in view of new societal and technological developments. In contrast to geo-information programmes offered elsewhere in the Netherlands (Wageningen University, Utrecht University, ITC Enschede, and at polytechnic level at Hogeschool Utrecht), the MSc programme at TU Delft builds upon the pool of expertise offered by the three participating faculties to offer a profoundly technical approach to data acquisition, information processing and management and application in the field of Civil Engineering and Earth Sciences. The programme started in September 2005 with six candidates, three from the phased-out TU Delft Geodesy programme and three from other backgrounds. In September 2006 ten students embarked on the course: eight of whom 'new', four from abroad. Four international exchange students also enrolled. The target is for thirty new students to enrol by September 2008.

Society

Geomatics is very much alive and public interest in geo-information science has never been greater. In 2004 the famous and authoritative journal Nature indicated that geo-information technology belonged to the top three fastest developing disciplines, together with biotechnology and nano-technology (US Department of Labour). Mobile navigation systems and Google Earth are now 'killer apps'. Media are increasingly interactive and the public is getting used to obtaining information about whatever, whenever: the entire world has become one huge GIS, accessible via the internet.

Technology

As geo-information becomes more detailed, height is of increasing interest, as is planar position. The programme, therefore, has an enhanced focus on the fields of optical and laser remote sensing, computer vision, computer graphics, computational geometry and spatial-data handling. Three-dimensionality of geo-information is addressed by the integration of Computer Aided Design (CAD) with GIS, to model the interaction between Civil Engineering & Geosciences and Geo-information science. GIS is used not only for describing static situations but also for recording dynamic processes on different time-scales, from moving vehicles in a motorway network to sequences of events during the construction of buildings and infrastructure to subsidence of land and rising sea-levels. This means taking into consideration the time dimension, for example in spatio-temporal querying, with results that are functions of position and time. Another highly interesting role in geo-information science is being played by satellite positioning such as GPS, to be augmented in the near future by Galileo. All these exciting developments are addressed in diverse courses making up the programme.

Programme Elements

The two-year programme covers a total of 120 ECTS and consists of courses in three subject domains, each containing core courses compulsory for all participants and elective courses from among which participants may choose. Domain 1 concerns a systematic and geodetically sound approach to data acquisition and information extraction, covering surveying, satellite positioning, photogrammetry and remote sensing from terrestrial, marine, airborne and space-borne platforms, based on optical, laser, radar and acoustic and seismic sensors. The core courses consist of satellite navigation and advanced remote sensing; electives listed in Table 2. Domain 2 concerns an information systems approach to storage, processing, management, dissemination and visualisation of data and information, based on Data Analysis methodology and Spatio-temporal Database Management Systems technology, with attention too for legal and organisational aspects of geo-information. The core courses consist of Geo-database management systems and Location-based services; electives listed in Table 2. Domain 3 concerns the role of geo-information in decision-making within a broad spectrum of the fields of Civil Engineering & Geosciences, covering design & construction, hydraulic engineering, water management, transport & planning and geo-technology. There is only one core course: Organisational and Legal Aspects of Geo-information, and there is thus an additional free elective course allowing candidates to deepen their knowledge of a certain application field. To ensure a proper balance between breadth

and depth, students are expected to put a certain emphasis on either acquisition or processing through their choice of track. Additional free elective courses allow for deepening or broadening knowledge.

Synthesis and Graduation

The synthesis project, carried out in the second year within groups of about five students, provides a synopsis of the different disciplines and aims at practising teamwork in small groups. This exposes students to the entire chain, from project definition, acquisition, data processing and analysis, presentation and delivery to application, working in a team within an interdisciplinary environment and understanding how the results of the geo-information process are used and applied. The first project was executed in September-October 2006 with as its subject the use of PS-InSAR (Persistent Scatterer Interferometric Synthetic Aperture Radar) for monitoring deformation of dikes. The results of the project received national media attention! The subject changes every year. The graduation project is an individual research assignment wherein a strong relation to a field of application is encouraged, supervised by interfaculty teams. Carrying out research for graduation projects in organisations outside the TU Delft will also be encouraged.

Convergence and Deficiency

Because (under)graduates come from a range of backgrounds it is necessary to assess prior knowledge. A distinction is made between deficiency, which is a lack of knowledge of general and predominantly mathematical subjects, and convergence, a lack of Geomatics knowledge. Before embarking on the programme candidates are expected to have prior knowledge of mathematics, including differential and integral calculus, linear algebra, matrix theory and elements of numerical analysis. Candidates not fulfilling these requirements are entered on a 'deficiency' programme, extending the total time needed to complete the MSc in Geomatics. To bring diverse participants to common level while avoiding duplication and repetition for an individual student, a 'convergence' programme is offered within the timeframe of the Geomatics MSc curriculum. This may consist of Geomatics subjects at introductory level concerning reference systems, cartographic projections, basics and physics of remote sensing, programming, DBMS, CAD, computer graphics, spatial data structures and algorithms, geo-statistics, and probability and observation theory.

Targeted Audience

Being a specialist subject, Geomatics appeals to candidates of academic maturity at BSc level. As an interdisciplinary science, Geomatics is an appropriate choice for graduates with backgrounds in related fields from faculties within the TU Delft and from other universities. For talented BSc-level graduates from related polytechnic programmes the Geomatics MSc provides an opportunity to progress to academic level. Geomatics is expected to attract the interest of students from abroad, including developing parts of the world, given the importance of geo-information as an asset during infrastructure development, management of natural and earth resources, water management, and urban development. Attending a specialised Geomatics MSc at the TU Delft after obtaining a BSc degree in one's home country is an attractive proposition for many candidates from all over the world.

Concluding Remarks

Graduates of Geomatics from the TU Delft will be able to deliver valuable technological and methodological contributions to industry and the public sector and to society in general in all domains concerned with the production, management, dissemination and application of geo-information.