UNIVERSITAT POLITÈCNICA DE CATALUNYA
BARCELONATECH

INFORME DE SEGUIMENT DE TITULACIÓ (IST)

MASTER OF SCIENCE IN COMPUTATIONAL MECHANICS

Escola Tècnica Superior d'Enginyers de Camins, Canals i Ports de Barcelona
Curs acadèmic 2010/2011

INFORMACIÓ DE CONTEXT

Nom titulació

Master of Science in Computational Mechanics

Lloc d'impartició

Escola Tècnica Superior d`Enginyers de Camins, Canals i Ports de Barcelona

Enllaç web

http://www.cimne.com/cm-master/

Enllaç al SGIQ

http://www.upc.edu/aprendre/estudis/master-universitari

Tipus de docència

Presencial

Nombre de crèdits ECTS

120

Idiomes

Anglès

Organització

Departament de Matemàtica Aplicada III (MA3) Departament de Resistència de Materials i Estructures a l'Enginyeria (RMEE) Escola Tècnica Superior d'Enginyers de Camins, Canals i Ports de Barcelona (ETSECCPB)

Institucions participants

Universitat Politècnica de Catalunya (UPC) École Central de Nantes (França) Swansea University (Regne Unit) Universität Stuttgart (Alemanya)

Programa europeu

Erasmus Mundus

Informació acadèmica

Aquest màster interuniversitari Erasmus Mundus pretén desenvolupar els coneixements i les competències en l'àmbit de la mecànica computacional, amb aplicacions en sòlids, fluids i altres camps interdisciplinaris. La formació inclou coneixements i tècniques de modelització, formulació, anàlisi i aplicació d'eines de simulació a problemes d'enginyeria avançats.

INFORMACIÓ PÚBLICA

ANÀLISI VALORATIVA

The programme of the mastercourse, in the 5th edition of the master, follows the main lines devised in the accreditation, as described in the next sections.

The programme of the master is fully implemented and provides very good results.

* Structure and contents of the programme

The overall collaborative structure of the master draws upon the strength of all partner institutions, providing a breadth of learning that could not be achieved by a single institution. The Masters programme consists of two parts. It amounts to 120 ECTS credits and lasts for two academic years. Part I provides basic background in computational mechanics as well as a practical training component. Part II includes a series of specialised modules in a particular field of computational mechanics and a research component.

* Students Services and Facilities

All partner institutions have wide-ranging experience with international exchanges and have well-developed logistical systems to coordinate the welcome and assistance of international students.

* Organisation of the master in a truly integrated way.

The master consists of a jointly developed curriculum which plays to the strength of every consortium partner. The integrated design of the master is improved on a yearly basis through the constant feedback of students, industrial partners and academic members to the Board of Studies (BoS) of the programme.

* Internships

The interaction of the students with the professional socio-economic sector is one of the main goals of the master in Computational Mechanics. This has been achieved through Internships.

Number of Industrial Placements: 59

48 (81%) at companies

11 (19%) at research centres

Students currently hired at the company where they carried out the Industrial Placement 8 (19%)

Companies that, after hosting a student, hire a graduate of the master 8 (24%)

Number of companies involved in Industrial Placements 33

Number of seminars given by companies 10

Number of research centres involved in Industrial Placements 11

Number of Master Thesis of immediate impact into industry 4

Graduates following a PhD programme 40%

* Mobility

Students attend at least two Institutions: The first Institution (either Barcelona or Swansea) is responsible for teaching 60 ECTS and the second Institution (Stuttgart, Nantes, Barcelona or Swansea) is responsible for the remaining 60 ECTS.

The institutions of the consortium are highly complementary in relation to their areas of expertise.

* Master Thesis

The Masters Thesis can be research or industry orientated, in both cases under the guidance of an academic advisor. The student carries out the thesis on a topic related to one of his/her areas of specialisation. The thesis should be submitted by the end of the second academic session. Once completed, the Masters thesis is defended in front of a local committee, with the assessment of an external reviewer.

* evaluation

The consortium has successfully implemented joint examination procedures. These procedures ensure a fair treatment of students regardless of the institution they attend.

The evaluation of the Practical Training module is carried out in conjunction with the industrial contact in charge of supervising the work of the student within the company.

The Masters theses arise from areas of specialisation from the host institution where the student is place during the second year.

* Learning outcomes

The master in Computational Mechanics aims to provide the students with the skills for the modelling, formulation, analysis and implementation of simulation tools for advanced engineering problems. The master also provides general outcomes which can be summarised as follows,

· General knowledge of computational mechanics

o Knowledge of the field of Computational Mechanics as well as advanced training in specific topics.

o Computing skills: use existing software and knowledge of programming languages.

· Practical training/entrepreneurship skills

o Development of innovative and enterprising spirit to carry out business activities.

o Facilitate the creation of new technology-based (knowledge-based) SMEs.

o Offer the possibility of working with software tools for planning and monitoring of projects.

o Improved employability through the practical training in industry.

o Exposure to Industry-University relationships for those MSc Theses with an industry orientated topic.

o Understanding of the applicability and shortcomings of existing technology.

· Transversal skills

o Integrative approach to problem solving, incorporating theoretical and practical knowledge and skills.

o Time management, independent and group study.

o Search and gathering of information (i.e. use of bibliographic resources, web-based search engines).

· Language/cultural skills

o Effective integration in a multicultural environment and undertaking lifelong learning.

o Exposure to the European and worldwide computational mechanics community.

o Communication skills: oral presentations, clear and concise professional and scientific reporting.

The Student Handbook can be accessed through the course portal, so that students can have detailed information regarding every module, including assessment criteria and learning outcomes. Further information such as scholarships, application procedure, and services at each institution is also available. Moreover, points of contact are available for students in case they need to e-mail lecturers or administrative staff for further information. The site also includes practical information about each of the cities in which the partner universities are located. This includes weather, accommodation and travel information. Finally, a direct link to the website of the universities comprising the consortium is included.

All the information is available at the master webpage. It is open to everyone and can be easily found from the main page of the portal.

All the public information available at the master webpage fulfills the quality requirements of the students and applicants.

The different groups interested in the master information are able to find all the information they require via the mastercourse portal. Additionally, the specific information related to administrative tasks of students can be accessed via the different virtual-environments provided by UPC.

The control mechanisms implemented by the university and the consortium to guarantee the availability of up-to-date information worked properly during the 5 years of the implementation of the master.

PROPOSTES DE MILLORA (seguiment 2011)

Codi	1.1/2011
Acció	Modify time distribution of mobility
Estat	En procés

Descripció: After the experience in visa issuing, housing and academic performance, the proposal is to move from the original 35ECTS in the first institution and 85ECTS in the second to 60 + 60.

Responsable: Consortium board of studies

Prioritat: Alta

Calendari d'implantació: September 2012

Resultat: Verification of the program modification in progress (national agencies and European Erasmus Mundus

INFORMACIÓ PÚBLICA SOBRE ELS INDICADORS DE L'ENSENYAMENT

Indicadors per al Desenvolupament i Anàlisi de les Titulacions(FONT : WINDDAT - AQU)

Accés a l'aplicació WINDDAT (Master of Science in Computational Mechanics):

http://winddat.aqu.cat/universitat/24/centre/2408032877/estudi/DGU000000333/?codi_any_a cademic=2010

Indicadors per al desenvolupament i l´anàlisi de les titulacions (FONT : UPC)

% d'hores per metodologia docent

Mètodes docents *(Font: AAD)* *Curs 2009/2010*	Teoria	Problemes	TFC	Laboratori	Altres	Total
% d'hores per metodologia docent	97,88	0,00	1,05	1,08	0,00	100,00
Mitjana UPC	37,35	15,80	14,91	29,33	2,61	100,00

Taxa de graduació

Resultats acadèmics *Curs 2008/2009*	
Taxa de graduació	88,9

Taxa d'abandonament

Resultats acadèmics *Curs 2008/2009*	
Taxa d'abandonament	5,9

ANÀLISI VALORATIVA

The quantification of the evolution of the master results and outputs is done via different quality measurements. Some measures are general -number of students, number of scholarships, number of self-funded students, etc- and some measures are aimed to quantify an specific goal of the master. For example to measure the employability of the students we measure, number of student working at companies, number of students following PhD programs, number of students working at the company where he/she did the Intership, etc.

The statistics of the master can be found in several places:

The UPC provides information on all the degrees awarded since 1978 at www.upc.edu/dades. All that information is public.

In addition in the web of the master (http://www.cimne.com/cm-master/stats.asp) specific data

of the master can be found.

In addition most of this information is available at UNEIX, the system collecting the information of all catalan universities.

The indicators available at WINDDAT - AQU show a steady number of students in the master. Most of the figures there are difficult to interpret or difficult to apply in the context of an Erasmus Mundus master as the Master in Computational Mechanics (for example "Evolució: Oferta demanda" or "indicador: Evolució: Distribució dels alumnes de nou ingrés segons crèdits ordinaris matriculats")

On the other hand the master in Computational Mechanics is in its fifth edition, thus there is no large history of data to interpret. Nevertheless, some internal indicators show an positive evolution of the master. For example, the number of self-funded students is growing steadily, the number of students hired in the company where they did the internship is also growing.

All partner institutions have wide-ranging experience with international exchanges and have well-developed logistical systems to coordinate the welcome and assistance of international students.

The consortium has successfully implemented joint examination procedures, which have been applied since October 2007. These procedures, as described in depth in the Student Handbook30, ensure a fair treatment of students regardless of the institution they attend. A common ECTS mechanism is in place among all the consortium partners and common assessment criteria are used across all the EMMC partners.

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PROPOSTES DE MILLORA (seguiment 2011)

No hi ha propostes de millora per aquest apartat

SISTEMA DE GARANTIA DE QUALITAT

ENLLAÇ AL SISTEMA DE GARANTIA DE QUALITAT

http://www.upc.edu/aprendre/estudis/master-universitari

ANÀLISI VALORATIVA

A Board of Studies (BoS) has been in place since 2007 to constantly monitor the quality of the EMMC programme. The BoS is responsible for ensuring that the EMMC offered under the MoA is delivered to the highest standards following appropriate evaluation mechanisms. The constant work of the BoS throughout the year (summer and winter meetings) has enabled in the past and will enable in the future the identification of academic/administrative issues which require adaptation or improvement in order to ensure these high standards are maintained. One notable example is the restructuring of the EMMC programme from a 1:3 semester distribution between host institutions to a 2:2 semester distribution, as a result of the feedback provided by the international offices within the host institutions. This change has been brought about in response to difficulties in the time required for issuing of third country student visas. Another notable example is the introduction of the   Entrepreneurship   content in response to feedback provided by our industrial contacts. A third example is the introduction of a   Communication skills in a foreign language   module in response to the feedback provided by the EMMC students.

The BoS has ensured that all partner institutions remain fully committed to all quality assurance and evaluation procedures (i.e. student feedback questionnaires, exam moderation

and external Masters theses evaluation). The BoS monitors that these procedures are followed and that the consortium partners are fully engaged to bring 23 EMMC in Computational Mechanics proposal. Award criteria forward measures to improve them even more. Finally, the BoS has the power to require a partner institution to withdraw from the consortium, if the internal evaluation procedures are not respected.

Quality assurance is critical to the consortium and any developments within the EMMC programme are always carried out in light of the Erasmus Mundus Quality Assurance for International Higher Education Courses National Evaluation. Each partner institution within the consortium operates with strict quality assurance procedures that have been established in accordance with both national requirements (e.g. the Quality Assurance Agency in the UK) and in accordance with the European Quality Framework and the Bologna Process. The primary responsibility for academic standards and quality rests with the BoS and the institutions comprising the consortium. The EMMC in Computational Mechanics has been externally evaluated.

Professional Evaluation. The professional and industrial relevance of the EMMC programme has been recognised for the years 2007-2012 by the UK Joint Board of Moderators (JBM) 52 which is comprised of the following U.K. Engineering professional institutions: the Institution of Civil Engineers, the Institution of Structural Engineers, the Institution of Highways and Transportation, and the Institute of Highway Incorporated Engineers.

PROPOSTES DE MILLORA (seguiment 2011)
No hi ha propostes de millora per aquest apartat

RESPOSTA A LES RECOMANACIONS D'ESPECIAL SEGUIMENT DE L'INFORME FINAL DE L'AGÈNCIA
A l'informe ANECA no hi ha recomanacions d'especial seguiment

VALORACIÓ GENERAL DE L'ASSOLIMENT DELS OBJECTIUS DE LA TITULACIÓ

The aim of the EMMC is to provide in-depth training in the application of state-of-the-art computational techniques for the modelling/solution of cutting-edge engineering problems in industry, with a European perspective. This training will involve multi-disciplinary modelling, inter-disciplinary modelling and new emerging fields, with a highlighted industrial edge.

The specific objectives are to provide students with:

Obj1 A general knowledge of the theory of computational mechanics, including the strengths and weaknesses of the approach, to appreciate the value of undertaking a computational simulation in an industrial context.

Obj2 Computer experience in the use of computational mechanics for the solution of current practical engineering applications by using modern software. Students will be able to apply the approach with confidence in an industrial context.

Obj3 Training in the development of new software and judicious use of advanced codes for the improved simulation of current engineering problems.

Obj4 A placement in industry in order to gain real training in the application of computational mechanics. In this way, students will improve their future employability prospects.

Obj5 A wide choice of specialisation areas by incorporating complementary modules from four leading European institutions. This will allow students to experience Postgraduate education in more than one European institution with the consequent cultural enrichment.

The following Table demonstrates the effectiveness of the EMMC programme in enhancing the employability and academic opportunities of the students in relation to the objectives Obj1 to Obj5.

The Table shows that both Obj4 (enhance employability) and Obj5 (Postgraduate education) are clearly achieved. The large percentage of graduates working in either Industry or pursuing a PhD programme related to Computational Mechanics (76%) shows the clear accomplishment of Obj1, Obj2 and Obj3.

Percentage of graduates...

...working in industry 55%

...working in industry and carrying out computational mechanics related tasks 39%

...working at the company where they did their Practical Training 19%

...following a Doctoral (PhD) programme 40%

...following a Doctoral (PhD) programme related to computational mechanics 37%

Nevertheless, there is place for improvements to the existing EMMC.

The structure of the programme could be improved to solve practical issues:

1. The EMMC has the mobility set right after the first semester. This brings issues for non-European students that needed to obtain two visas (UK/Schengen) in a short period of time. A change in the mobility to the middle of the programme, after the second semester, could to minimise this problem.

2. In the current version of the EMMC, most of the workload is concentrated during the first year. Students feel that a more equal distribution of taught modules throughout the two years of the EMMC programme would help to reduce the high workload of the first year, while increasing the benefit of advanced modules after their having gained some practical experience. In response to that, second and third semesters can be altered, with the Industrial Placement moved forward to the second semester.

3. Introduction of a Third Country Institution (Tsinghua University) to enhance the attractiveness of the overall programme, allowing European students to engage in education in a different cultural environment.

4. Addition of a series of language/transversal skills courses in order to facilitate mobility and integration into industry.

5. Organisation of a Joint Summer School to encourage the interactions of academics, students and industrial contacts.

ELABORACIÓ DE L'INFORME

Agents implicats			
Lelia Zielonka	Secretaria	Cimne	
Pedro Díez	Vice rector de relaciones internacionales	DMAIII	Responsable Acadèmic
Sergio Zlotnik	Profesor Lector	DMAIII	Responsable IST

ÒRGAN COL.LEGIAT DE GOVERN O UNIPERSONAL QUE VALIDA L'INFORME

Pedro Díez, Director del Master, 4 de junio de 2012