

Second year of the project „IMPROVENG“

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Das Projekt IMPROVENG beschäftigt sich mit der Übertragung der „deutschen Art“ Maschinenbau zu lehren nach Mexiko, da dort ein Defizit an Fächern, die sich mit der Konstruktion und Entwicklung neuer Maschinen beschäftigen, besteht. Die mexikanische Industrie wird aber in Zukunft immer mehr Ingenieure dieser Qualifikation benötigen, um den Aufstieg von einem „Zuliefererland“ zu einem „Entwicklerland“ zu schaffen.



1 Introduction

Within this project, the basics of the German educational system shall be evaluated with respect to applicability in Mexican universities and transferred to Mexico, because the project oriented application of basic sciences including the challenge of a time-management in teaching mathematics, mechanics, material sciences, manufacturing and design like it is part of the curricula in Europe is up to now not known in Mexico. By introducing and evaluating this in a pilot project at the CUCEI (Centro Universitario de Ciencias exactas e Ingenierias) in Guadalajara it is possible to extend these structures to other Mexican universities. This project has started in 2006 and is planned for four years.

In the year 2006 Prof. Dr. Peter Dietz and Dipl.-Math. Bianca Sambale stayed about two weeks in Mexico. In this time several meetings with the University of Guadalajara, Instituto Tecnológico of Irapuato and the Instituto Tecnológico of Queretaro were held to analyse the Mexican curriculum, also the lecture “Konstruktionslehre” (Methodology of Design) had taken place in Guadalajara in the first week. Several students and members of the industry participated this lecture.

The analysis of the Mexican curriculum of mechanical engineering, extensions and shortenings on it were made during the first week of this stay. Also a PowerPoint presentation about this work was made and presented to participants of the university, industry and state institutions of Guadalajara.

A second journey which was planned for the second half of the year 2006 could not be made because of time problems on both sides. This second journey was transferred in the first half of the year 2007.

2 Report of stay

The second visit of members of the IMW (Institut für Maschinenwesen) of the TUC (Technische Universität Clausthal) at the CUCEI (Centro Universitario de Ciencias Exactas e Ingenierías) of the UdeG (Universidad de Guadalajara) in Guadalajara within this project had taken place in March 2007 for ten days. This time Prof. Dr. Peter Dietz and Dipl.-Math. Bianca Sambale were accompanied of Dipl.-Ing. Oliver Habel of the IMAB (Institut für Maschinelle Anlagentechnik und Betriebsfestigkeit) in the last six days of their stay in Mexico. They arrived at Guadalajara airport at March 20th and stayed until March 30th of 2007. In this time two lectures were held: "Elementos de construcción I" (Prof. Dr.-Ing. Dietz) and "De la medición de cargas a la calculación de vida útil" (Dipl.-Ing. Habel). Additionally meetings with professors from the UdeG and industry members were arranged and the work on the project was carried on.

2.1 Project work

Last year the Mexican curriculum was analysed to clarify the need of new lectures and changes. Based on the resulting proposals a new proposal was constructed from Mexican side since the last project meeting and now presented by Mr. Victor Rangel to the German project members on March 21st:

1. semestre	Cred.	2. semestre	Cred.	3. semestre	Cred.	4. semestre	Cred.	5. semestre	Cred.	6. semestre	Cred.	7. semestre	Cred.	8. semestre	Cred.	9. semestre
Matemát. para Ing. 1	9	Matemát. para Ing. 2	9	Matemát. para Ing. 3	9	Matemát. para Ing. 4	9	Cálculo con elementos finitos	9	Máquinas térmicas	5	Instalaciones eléctricas	5	Máquinas eléctricas 2	5	Instru- mentación
Estática	9	Dinámica	9	Termo- dinámica	9	Electro- magnetismo	9	Circuitos eléctricos	5	Instalaciones mecánicas	5	Máquinas eléctricas 1	6	Lab. Maq. Eléctricas 2	2	Robótica
Labor. Física 1	2	Labor. Física 2	2	Labor. Física 3	2	Labor. Física 4	2	Fluidos	5	Nuevos procesos manufactura	5	Lab. Maq. Eléctricas 1	2	Refrigeración y aire	5	Product Data Management
Química básica	6	Procesos de manufactura 1	6	Procesos de manufactura 2	6	Transfe- rencia de calor	5	Lab. neum. e hidráulica	2	Lab. Maq. Térmicas	2	Máquinas hidráulicas	6	Control	5	Micro- manufactura
Dibujo industrial	3	Lab. Manuf. 1	2	Lab. Manuf. 2	2	Elemen. de diseño 1	6	Mediciones en Ing.	5	Mecánica de materiales (para el diseño) 2	5	Lab. Maq. Hidráulicas	2	Resistencia y fatiga 2	5	Proyecto mecatrónico
Introd. Computación	3	Administración	5	Elemen. Ing. industrial	5	CAD	5	Mecánica de materiales (para diseño) 1	5	Elemen. de diseño 3	6	Resistencia y fatiga 1	5	Metodología del Diseño 2	6	Automatiza- ción de sistemas
Optativa abierta 1	5	Etica profesional	4	Optativa abierta 3	5	Materiales	5	Elemen. de diseño 2	6	Proyecto de diseño 3	2	Metodología del diseño 1	6	Maq. de transf. hidrául. y neumá.	5	Optativa especiali- zante 2
		Optativa abierta 2	5			Proy. de diseño 1	2	Proyecto de diseño 2	2	Calidad	5	Optativa especiali- zante 1	5	Elementos mecatró-nicos	5	Optativa especiali- zante 3
						Admon. oper. manuf.	5	Planeación y control de producción	5	Electrón. analógica	5	CIM	5	Maq. Herra- mientas	5	Maquina- bilidad
	37		42		38		48		44		45		45		43	

Básicas
 Proyectos
 Industrial
 Mecánica Eléctrica

Área de formación básica común
 Área de formación básica particular

Figure 1: Proposal CUCEI

This proposal is special and it is different from the earlier made proposals in one specific way - it unites three departments:



Figure 2: Career with multi departmental support

The Department of Industrial Engineering, the Department of Engineering Projects and the Department of Mechanical and Electrical Engineering.

Normally a collegiate career in Mexico is just placed in one department. Every lecture a student has to visit is given by this department. Because of this, the students are too much specialised in their study.

By this change a “Ingeniero de Manufactura” will have a better basic

knowledge of all themes, which he will need in his future life.

This proposal was not satisfying, because of the immense quantity of hours per week. After the revision of the existing proposal, in which some specialisations and shortenings were made, the quantity of hours was set to average 25 hours per week:

1. semestre	2. semestre	3. semestre	4. semestre	5. semestre	6. semestre	7. semestre	8. semestre	9. semestre	10. semestre	
Matemát. para Ing. 1	Matemát. para Ing. 2	Matemát. para Ing. 3	Matemát. para Ing. 4	Cálculo con elementos finitos	Elemen. de diseño 3	Máquinas eléctricas 1	practicas industriales	Máquinas transf. Mecánicas	Instru- mentación	
Estática	Dinámica	Termo- dinámica	Electro- magnetismo	Circuitos eléctricos	Proyecto de diseño 3	Resistencia y fatiga 1		Lab. Maq. Eléctricas	Product Data Management	
Labor. Física 1	Labor. Física 2	Labor. Física 3	Transfe- rencia de calor	Fluidos	Ingeniería económ. 1	Metodología del diseño 1		Control	Proyecto mecatrónico	
Química básica	Procesos de manuf. 2	resistencia de materiales	Materiales 2 (para diseño)	Mediciones en Ing.	Máquinas térmicas	Electrónica digital		Elementos mecatró- nicos	optativas especialisante: robotica, micro manufactura, automatización, maquina bilidad	
Dibujo industrial	Lab. Manuf. 1	Lab. Manuf. 2	Elemen. de diseño 1	Elemen. de diseño 2	Instalaciones mecánicas	Ingeniería económ. 2		Maq. Herra- mientas		
Introd. Computación	Adminis- tración	CAD	proyecto de diseño 1	proyecto de diseño 2	Lab. Máqui. térmicas	optativas espec.: Instalaciones eléctricas, Máquinas hidráulicas + Lab. CIM		optativas especialisante: refrigeration, fatiga 2, metodologia 2, maquinas de transferencia		
Optativa abierta 1	Optativa abierta 2	materiales 1	Admin. oper. manuf.	Lab. neum. e hidráulica	Nuevos procesos manufactura	Calidad		Electrón. analógica		
Procesos de manuf. 1	Com putacion	Optativa abierta 3	Lab. Materiales	Planeación y control de producción	Optativa abierta 4					
24	25	25	26	24	26	25		25	25	25

Figure 3: Career after shortening

The “optativas” (arbitrary lectures) were divided in two possible careers: “diseno, manufactura y procesos” and “automatizacion y control de equipos y procesos”:

1		diseno, manufactura y procesos	horas
obligatorios	Materiales 2 (para diseño) + Lab		5
	Cálculo con elementos finitos		4
	Proyecto en maquinas		3
	Nuevos procesos manufactura		3
	Resistencia y fatiga 1		3
			18
especialisante	Fluidos		
	Máquinas térmicas + Lab		
	Maq. Herramientas		
	CIM		
	micro manufactura		
	refrigeration		
	fatiga 2		
	metodologia 2		
	Máquinas hidráulicas + Lab		
Transferencia de calor			
2		automatizacion y control de equipos y procesos	horas
obligatorios	Electrón. analógica		3
	Electrónica digital		3
	Instalaciones eléctricas		3
	automatizacion		3
	Lab electronico/automatizacion		3
	Proyecto mecatrónico		3
			18
especialisante	CIM		
	robotica		
	Elementos mecatrónicos		

Figure 4: Possible careers

This Career was presented to the rectorate on Wednesday, 28.03.2007 and to representatives of the Mexican industry and the DAAD on Friday, 30.03.2007. Both groups agreed in the necessity of a new engineering career for Mexico and support this new curriculum as a step in the right direction.

Furthermore meetings with representatives of the Departments of Engineering and the CIATEJ, CONACYT were held, in which the problems which may appear during the adoption were discussed. Every participant of these meetings guaranteed their encouragement for

the project because of the understanding of the meaningfulness of this project for the future of Mexican mechanical engineering career.

2.2 Lectures

The two lectures which were held in Spanish during the stay were compressed lectures of the new ones which have to be integrated in the new career. The documents which were needed for this were translated with the help of Spanish double diploma students, who are also translating the documents for the next lectures.

Participants in these lectures were students and professors from the UdeG, but also professors from other universities of Mexico and representatives from Mexican industries.



Figure 5: Lectures of Prof. Dietz (right) and Dipl.-Ing. Habel (above)

3 Further steps and changes

The first part of the lecture “Elementos de construcción I” was held and the second part will be hold by Prof. Dietz in January 2008. Prof. Lohrengel who had taken over this project in the current year, will also attend Prof. Dietz on his trip to Mexico next year, to get in contact with the participants and to clear the next steps in the project. Additionally discussions about the possibility of involving a double diploma into this new career are planned during the visits. This double diploma would give Mexican and German students the possibility of getting experiences in the partner countries, learning foreign languages, receiving social competences and gaining from the different ways of teaching mechanical engineering.

id	Task	2006				2007				2008				2009			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	Determination of requirements, program conception																
2	Add on arrangements alongside the course																
3	Clarification of Curriculum																
4	Participation of Mexican Professors in German University																
5	Introduction of new engineering career																
6	Evaluation and improvement, adoption in Mexican Curriculum																

Figure 6: Timetable of the project IMPROVENG

The journeys of the German professors in the beginning of 2008 will be followed by the visit of two Mexican professors (Dr. Juan Villavazo and Dr. Rubén Ruelas) participating lectures in Clausthal in February 2008. These visits of the Mexican professors were also planned in 2007, when they should have helped to translate lectures in Spanish. Unfortunately these two visits have to take place in the beginning of 2008, because all the people involved could just make it at this time. Concerning the visit of the Mexicans this means, that there was a need of more working hours for translation of lectures.

Next year two Mexican professors (V́ctor Rangel and Daniel Mart́nez) will come to Clausthal in 2008, to learn more about our lectures and to translate some of them in Spanish.

4 Perspective

This project was planned for four years. First, it was just encouraged by the DAAD until the end of this year. But to stop the encouragement of the project at this moment would mean to stop the new career. The curriculum of the new career is up to now not enough tightened and needs much encouragement of the German partners, not only because the rector of the Mexican University has changed, but also because of the lack of knowledge and experience which would then occur. Therefore the DAAD will encourage the project for another two years.