Preliminary Results of the University of Florida College of Engineering Projection to Latin America and the Caribbean

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Abstract
In a previous work we presented the initiative that the University of Florida's College of Engineering (UF-COE) is undertaking to develop an International Engineering Program (IEP). In that work we discussed the objectives of our UF-COE-IEP program in terms of our interest on opening doors of opportunities into the world of international engineering, research and education.

The need for a UF-COE-IEP starts through the recognition of the importance of diversity, and that in today's highly technological world, far more so than in previous generations, the level of preparation required in higher education has increased dramatically, especially for engineers. Primarily oriented to Latin America and the Caribbean, our program is gaining momentum and starting to have an impact in the region and other areas of the globe.

In this work, we discuss some preliminary results of our UF-COE-IEP in terms of its main different areas established during its creation: International Courses and Seminars, Faculty and Students Exchange, Electronic Delivery of Graduate Education, Research Infrastructure, Masters and Ph.D. degrees, Tutoring Graduate thesis abroad, Dual degree programs, Energy Management Program, etc. In the light of our good results, we discuss our new strategies and projections seeking new collaborations. Finally, we reassure our commitment for continuing our efforts on opening doors of opportunities into the world of international engineering, research and education.

Keywords
International Engineering, Long Distance Courses

1. Introduction

Today's world requires that new engineers have a broader education/vision of the world. They must be able to interact with partners and competitors who speak different languages and view the world from different cultural perspectives. The success that they and their companies achieve will depend on research, development, and manufacturing carried out collaboratively with colleagues around the globe. Because of this, engineers must acquire international skills along with expertise in business, science and technology. National and multinational companies require from their new engineers that they not only be able to communicate in a different language, but also to have an understanding of the culture and the countries they will do business with.

Knowing more than one language as well as other cultures will put our students in significant advantage. In other words, by gaining valuable work experience in an international setting, our students will improve their marketability in today's competitive global economy. With an international component in their education students will get to network with leaders of top technical companies and like-minded students from around the world.

We strongly believe that the students that participate and put themselves through the hard work required by an International Engineering Program are precisely the engineers of the future that will lead the companies and industries of the future. As we discuss our thoughts with universities in Latin America and the Caribbean we share the same goals and consequently seek collaboration with them in the areas of International Courses and Seminars, Faculty and Students Exchange, Electronic Delivery of Graduate Education, Research Infrastructure, Masters and Ph.D. degrees, Tutoring Graduate thesis abroad, Dual degree programs, Energy Management Program, etc.

Internationalizing the curriculum in engineering should now be a natural part of the curriculum, as we live in a world that demands each day that new engineers have a broader education/vision of the world. These students must be able to interact with partners and competitors who speak different languages and view the world from different cultural perspectives. Because of this, the new engineers must acquire international skills along with expertise in business, science and technology. This is the message that industry is sending regarding the engineer of the future, that they not only be able to communicate in a different language, but also to have an understanding of the culture and the countries with which they will do business.

In this work we propose to continue working towards the International Engineering Program (IEP) in the University of Florida College of Engineering. So far, although young, the program embraces all UF-COE departments. It emphasizes the bi-directionality of the program so as to attract more, good graduate students from Latin America and the Caribbean, as well as to project the UF-COE to the region and the world through an IEP program. We hope to open doors of opportunity into the world of international engineering studies for UF-COE students, and to attract students directly or by developing distance education programs. We recognize the importance diversity, particularly the relevance of Latin America and the Caribbean, Spanish as the second language of the U.S. and the third most spoken language in the world. Recent economic initiatives, including NAFTA, have truly brought Latin America and the Caribbean to the forefront of international education.

In a mutual benefit relation, UF-COE students can benefit from seeing how Latin-America and the Caribbean have implemented these different ideas on their Industries, cities and communities. The University of Florida can offer here a tremendous wealth of opportunities for graduate studies for new students from the region, and develop new research collaboration programs as well. All for some Latin-American and Caribbean governments have embraced a number of economic management policies that dramatically affects their society. Some of these ideas have not been proposed before, or even considered impractical by other more developed countries. These issues are certainly part of the general scheme that will certainly improve our program for the benefit of the University of Florida, our partner institutions in Latin America and the Caribbean, industry, and the community at large.

In this context, our understanding on what needs to be done to achieve these goals has improved dramatically. In this work we present preliminary results on the evolution of our new International Engineering Program (IEP) and discuss progress each of its main components. The UF-COE IEP program offer programs to Latin America and the Caribbean that aim to attract graduate students mainly, projecting the University and its College of Engineering abroad as one of the leading academic institutions in the U.S.A. The program is designed to provide for UF-COE faculty and students to travel to partner institutions in LAC countries and for faculty and students in these institutions to travel to the U.S.A. or pursue programs via distance education, conferences, courses, seminars, new certifications, etc.

2. The New International Engineering Program

The University of Florida College of Engineering is a very well established one with eleven departments, ten of which offer undergraduate and graduate degrees (Master and Ph.D), and the 11^{th} (Biomedical) offering only graduate degrees. In addition, Minors are offered in sales engineering, materials science, computer engineering. The college is currently ranked in the top 16 among public peer institutions in the US (in 2005 the same ranking put UF at 20). All departments have top programs with faculty conducting cutting edge research.

The college has a variety of high trained faculty and researchers who through the International Engineering Program offer additional opportunities to our students. They represent the foundation upon which the college is built. In addition the college currently offers international programs, including study abroad opportunities for undergraduate and graduate students, that we shall discuss later on. As an example, on February collaboration agreements were signed with Universidad Privada del Norte in Peru (2006). Another will be signed in May (2006) with Universidad Catolica Andres Bello in Venezuela. Others are under exploration with Colombia, Brazil, and Chile.

The UF International Engineering Program (IEP) program is not intended to advertise our college, but to emphasize that our faculty is prepared to perform collaborative research with partner institutions abroad, give lectures at international meetings, and develop and deliver a strong engineering curriculum. The IEP at UF-COE encompasses new programs and courses, and will modify some already in place so as to give them an international component that offers a more global education to our students. It is designed to challenge the UF College of Engineering and its faculty to offer new programs to students all over the world. In this case, the

accent will be oriented to the LAC region, so as to attract the best students from the region through the offer of new and innovative programs.

The use and presentation of Case Studies from other countries, and use of new teaching tools, such as is the internet, represent innovations to be applied to accomplish our goals. Many of these are already in place at the University of Florida. As mentioned before, these goals will strengthen the UF-COE and its programs become a real challenge to the students. Those who participate in the challenging curriculum offered by the UF-COE IEP will be highly sought by potential employers. This is the criterion multinational companies are using, and UF-COE is ready to fulfill the commitment.

The UF-COE-IEP efforts are coordinated through the Florida Engineering Education Delivery System (FEEDS). The director works closely with the dean, associate deans, chairs, all academic coordinators and the UF International Center. Its main goals are:

- Establish international collaborative programs with well known established engineering programs in universities abroad.
- Keep the programs alive by promoting/advertising them in the marketplace.
- Participate in related national and international meetings so to expose the program and learn/grab new ideas, trends, and contacts.
- Apply for grants to support the program. The program is a dynamic one, and consequently it will be developed further by requesting collaboration from UF-COE faculty through an annual survey.

As shown on Figure 1, the UF-COE-IEP concentrates fundamentally on three areas: Faculty, Undergraduate, and Graduate programs. In the next section we will discuss its benefits and advantages, briefly describe them, and show their benefits and advantages:

The International Engineering Program at UF-COE the main goals of this include:

- To project UF-COE abroad, mainly to Latin America and the Caribbean. Other regions and countries of the world including Asia and Europe are also part of the effort.
- To create and promote opportunities in the global marketplace for the UF-COE.
- Explore Teaching Abroad and Research Collaboration opportunities
- Offer Study Abroad opportunities for UF-COE undergraduate students (and perhaps others in the State of Florida and the US).
- Strengthen relations with industry
- Increase the number and type of minors offered.
- Expand the graduate opportunities through Distance Education and Outreach programs.
- Increase the number of graduate students at UF-COE
- Expand UF-COE horizons and influence, by opening doors of collaboration in Latin America and the Caribbean

In addition to these there are additional goals set in parallel, which relate to the framework of this program. These include:

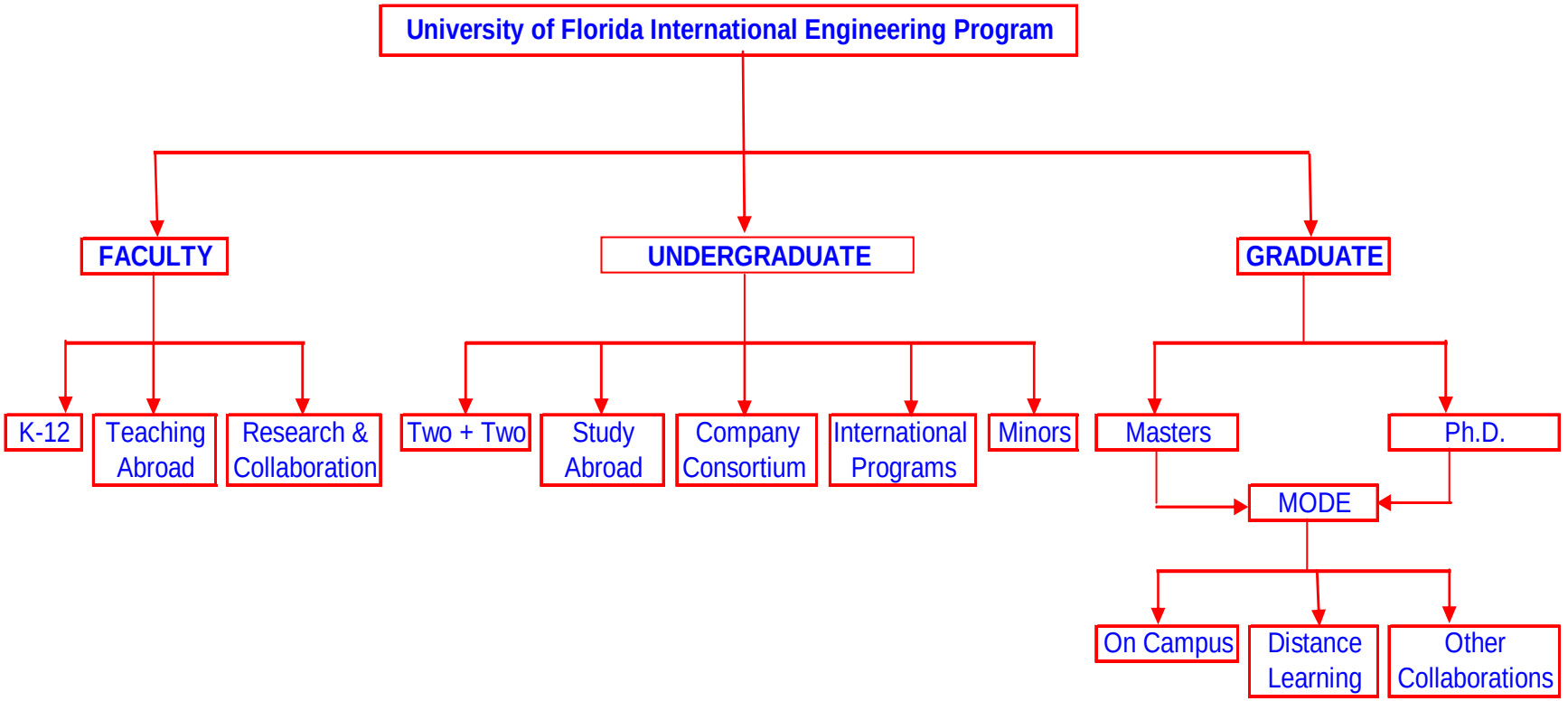

Figure 1. The University of Florida College of Engineering International Engineering Program

- Put our students in higher demand, and hence the UF-COE
- Undergraduate: To lead students to dual degrees in engineering and a language. Of special consideration should be German, Spanish, and French. The possibility of an extra minor in combination with business is under exploration.
- Undergraduate: Offer students and international component on their education through courses in universities abroad, international internships with corporate partners (and the possibility to be recruited by global companies).
- Offer international courses by UF-COE faculty, at UF and abroad.
- Offer Distance Learning graduate degrees.

3. Faculty

3.1 The K-12 Study Career Fair

We recognize here the importance of starting UF-COE influence and programs at early stages like K-12. This is particularly important for ensuring a good feeding and promotion of the program. UF-COE has established a very strong track record in this area, and this experience will be available for use by our new partners.

3.2 Teaching Abroad

This has proven to work just fine for IFAS faculty teaching in universities as ESPOL (Guayaquil, Ecuador), and others in Brazil. In this program we recognize the possibility of offering some courses at the local University by UF faculty instead of bringing foreign students to UF.

3.3. Faculty Research and Collaboration Programs

Since last year about 20 faculty from Latin America nd the Caribbean has visited UF College of Engineeering, and new collaborations a sought on this direction. Currently, the UF-COE has several collaboration programs that consider collaborative efforts on teaching, research, conferences in the country and abroad, and students exchange to: Peru, Chile, Ecuador, Colombia, Venezuela, etc. Other countries include Australia, New Zealand, China, and Korea

4. Undergraduate Program

Here we summarize the current and new programs at the UF-COE, some of these programs consider more professional oriented work, and some others collaborative international study abroad projects.

We seek bi-directionality in most of our programs so to allow exchange of engineering students. Our goal is to attract potential future graduate students. The time abroad is fully integrated in the curriculum, and participation should offer a double degree (if so desired by the student) despite a delay on the time of graduation.

4.1 The Two plus Two

Framed as a bidirectional program, participating students take courses from the first 2 years offered by their home University, which will be recognized when they come to UF for the second “two” part. In addition, students that come to UF through this program are considered to pay fees as if they were Florida residents. This is a program that considers students working half of their academic load in their home country in a local University, and the other half here at UF. A program of this type is in place and working successfully in Institute of Food and Agricultural Sciences (IFAS) with undergraduate students from Escuela Superior Politécnica del Litoral (ESPOL) – Ecuador. The program is called “two

plus two". Under this program, engineering students from Ecuador take the first 2 years of basic courses for an engineering program in their home country, and the last 2 years of the program at UF. A similar program with ESPOL is under exploration in the Department of Industrial and Systems Engineering. Participating students could take courses from the first 2 years offered by UF, which will be recognized when they come to UF for the second "two" part. In addition, students that come to UF through this program are considered to pay fees as if they were Florida residents.

4.2 Study Abroad

As stated before, these program is a two ways avenue, as it is clear that collaboration with other countries (Universities) in Europe, Latin America and the Caribbean, Asia, etc., should be established. We are currently seeking partnership with foreign Universities, locally accredited and hopefully with ABET certified programs or similar, so to establish similar programs. We consider here not only undergraduate students, and Masters degree students as well.

Some already started contacts and work includes, as an example, the Industrial Assessment Center in the Department of Industrial and Systems Engineering. This has started already working collaborations with exchange students and research/development projects with a few universities abroad: Peru, Colombia, Chile, Ecuador, Venezuela, etc.

Here we indicate the initial steps we follow so to establish the program. Particular emphasis will be made on how to expose COE to Latin America and the Caribbean. Of particular interest will be on undergraduate UF-COE students, in good standing (regular plus a minimum GPA), and local students from partner institutions in Latin America and the Caribbean.

- Staying Abroad Time: It may vary according to the program: A few weeks, a semester, a year, etc.
- UF-COE in good academic standing (a minimum GPA $\geq$ 3.0 should be required.
- Participation Level: Undergraduate: Junior – Senior; Graduate: Masters
- Language: Local University faculty should be able to teach in English, although is expected that UF students will get proficient in the local language
- Money/Tuition Payments: Here the difference is in tuition as partner institutions might be public or private. Partnership with local Universities is sought so that UF students get exempted from tuition payment. Students from the partner country coming to UF should be treated similarly. Housing should be provided too, or considered for discussion in the agreements.

A few programs in the study abroad format have been recently put together. They include:

- **International Industrial Energy Consulting:** Students travel to Chile to perform energy audits to manufacturing facilities. This course offered to all UF-COE

students, is unique in its nature as is not offered by any other college neither in the state of Florida nor in the U.S.

- **The University of Florida Paris - Campus:** Making use of this recently established office in downtown Paris, we are seeking new possibilities that so far has allowed for the realization of a Conference in Optimization. New programs are under study for the areas of Industrial Energy Management.
- **The South American UF Energy Expedition:** In collaboration with local faculty of Venezuela, Colombia, Ecuador, Peru and Chile, a new program is under development for a visit to all these countries with hands on in real world engineering problems. The course is framed as an study abroad one in the same lines as the first one listed here.
- **Engineers Without Borders:** Recently developed by faculty in the UF Department of Environmental Engineering, this program entails to take students to poor countries during the summer so that they can help very poor communities to build the necessary infrastructure that will improve peoples quality of life by building home, solving environmental problems, sanitation, etc.
- **Siemens International Engineering Program (IEP):** It started with 3 students last year. This is a Co-Op in Sales and Marketing in which students will spend the Fall 2004 term in Orlando, and in Germany for the Fall 2005 term. In this program are awarded a degree in Languages plus their BS in Engineering. Students are allowed to pursue other minors at UF as well.
- **The Integrated Product Process Design (IPPD):** This program considers a contract between the university and industry for the development of a project of interest by the company. The blue prints of a process, to build a prototype, to design a new process, etc. These program, of about 10 years of age, is now going international.

These are both unidirectional programs. However, for the first one efforts are being made so to have foreign students from Latin America to visit UF-COE. The goals of this program fully comply with the goals to be set for the COE-IEP office.

Other international programs are currently under development through the different departments of UF's College of Engineering with the collaboration of UF International Center, and will soon join these ones.

4.3 Company Consortium

This section of the program is very important for both undergraduate and graduate levels. We must remember that one of the main goals of the IEP program, is to promote and propel UF-COE to Latin America and the Caribbean and any other countries universities that we could contact/attract. For this purpose, we are looking for partnership with international companies. Some of it is already in place through the Integrated Product Process Design (IPPD) program and recently through companies like Siemens, Ingersoll-Rand, and others.

The participation of national and multinational companies calls for an additional prospect for the UF-COE-IEP. This is, the consideration of establishing a consortium of companies in our program that, to participate, will contribute with financial support pre-established by UF-COE-IEP. Funding will be directed to support students at UF-COE in agreement with the industry partner. Here, undergraduate and graduate student's memberships are considered.

Additional contributing possibilities are being explored in collaboration with industrial and abroad university partners so to attract local graduate students, and funds to support them.

4.4 Current International Programs

Some UF-COE programs are being internationalized. For these, UF-COE acts as field manager. So far they include: the Industrial Energy Management and the IPPD programs. Programs to come in the future are under exploration, the Solar Engineering program, Engineers without borders, etc.

4.5 Minors

The University of Florida College of Engineering offers a variety of minors that are available for students: Biomechanics, Statistics, Business, Mathematics, Packaging, Sales, etc. Although others are under preparation, these options are open to all our students, as they are regular programs.

5. Graduate Programs

As stated before, this work concentrates on the presentation of new graduate studies opportunities at the University of Florida College of Engineering. Currently, the UF-COE has a very well established and robust graduate program. Our goal is to expand it offering more graduate studies opportunities. This is, recently graduated students, engineers working in the field, or current faculty that would like to pursue a graduate degree.

The UF-COE currently offers Masters and Ph.D. programs in a myriad of specialties in all its departments, in what can be called the regular format. This is, to attend regular classes (after passing admission requirements). In this work we discuss the new graduate programs in a Long Distance Education mode offered through the internet.

5.1 Regular Graduate Program

The University of Florida College of Engineering has many capabilities that makes it one of the top strong programs in the country, highly ranked by the American Association of Universities. We have strong research programs, a sustained record of working with international students (graduate and undergraduate), our faculty includes world wide known researchers that conduct cutting edge research in practically all areas of engineering, write books, organize national and international conferences. In addition, the college has very well mounted laboratories and computers.

We can offer competitive fellowships for students pursuing a Ph.D. or Masters degree (they are limited, but open), Research and Teaching Assistantships (all research supported). The associated costs for a Masters degree currently are in the order of US$25,000. However, the UF-COE is offering a New Masters program for US$15,000. This program considers 30 credit hours.

5.2 Distance Learning

The Distance Learning programs have been established because we understand that people that want to pursue a graduate degree in engineering at UF not always have the possibility to go abroad. Consequently, one of the objectives of the program is to provide a person with the opportunity for graduate studies without having to move to the US, alleviating moving expenses, reducing fees, and more important to still continue working at the student home country. We believe that this issue makes it very attractive for the candidate and the employer as well. So far four Long Distance Education Masters Degrees programs exist. By the end of 2006, three more will be in place. The goal is that by 2008 all 12 Departments at UF-COE will offer Masters Degree programs.

For the Masters degree option, this alternative offers the same graduate possibilities as if the candidate were physically attending regular class at UF. This program entails that the students follow classes through the internet. In general the cost of such a program is, as stated before, about US$25,000. However, the cost for the Masters, Non-Thesis program, through the long distance education mode, is about for US$15,000 and it is a 30 credit hours. The UF-COE offers additional benefits for the candidate as is the option to be brought to UF for his/her graduation ceremony at no cost. We believe this to be a very competitive program.

On the other hand, the Ph.D. program is under study and being conceived as a Long-Distance one but in a “Two plus Two” mode. Because of the nature of the requirements for a Ph.D. degree, in a Distance Learning mode, this will be the only way we envision that a Ph.D. program can be offered. In other words, only the courses portion can be completed at the candidate home institution, whereas for the second half the student must be at the University of Florida campus so that he/she can get engaged in research with his/her supervisor.

Some of the undergraduate programs should be considered to be Bi-directional. This means that, as UF-COE establishes partnerships with universities abroad so to send UF-COE students to them for the different programs, the opposite direction is under exploration. The goal of this bi-directionality is that, as foreign graduate students come to UF-COE to participate in its international programs, and attract them to UF-COE to come back as graduate students. For this purpose, we have set foreign visiting students an application package with an invitation letter from the UF-COE Dean to join UF-COE’s graduate program. Among other issues, the letter points out that they should try to find their own support, but indicate as well that some help is available as they have participated in a UF-COE international program already.

5.3 Other Collaborations

It is the authors experience that some College of Engineering in many Universities in Latin America are increasing the academic level of their faculty. Some of them are professional engineers, or have a Masters degree, and very few have a Ph.D. These Universities (with about 2,000 to 10,000 students or more) understand that if they do not increase the level of education of their own faculty, their future will not look very bright. In this regard, the UF-COE has the flexibility to work with its partner institutions in Latin America and the Caribbean to upgrade their faculty degrees.

In addition, we know that some good candidates in Latin America are currently engineers that are working in industry, are faculty, etc. Even if they consider the possibility of coming to the United States to pursue a graduate degree, they are stopped by the working and living conditions that their desire for a graduate degree encompasses. Namely, they do not want to quit, and loose, their jobs to come to US. Most of them have family that they would not like to leave behind, etc.

Being these situations a reality in Latin America we believe these to be an "opportunity" to get good graduate students. The UF-COE has the experience, excellent academic record, research facilities, computer systems, flexibility, and the commitment to work with our partner universities and interested candidates, according to their constraints.

6. Programs Cost, Accreditation and UF-COE-IEP Participation Figures

The University of Florida College of Engineering is seeking to establish collaboration with partner universities in Latin America and the Caribbean to implement the programs described above and others to come.

6.1 Program Cost

We have conceived our Distance Learning Master program in such a way that Masters degree seeking students will have their fees waived. This is, and as of today, the current cost of a Masters degree at UF-COE is of US$25,000. We are prepared to offer a current cost of US$15,000 for the program. We believe that this is a very competitive cost as compared to other possibilities, with the additional benefit for the candidates of the resources, capabilities, choices and research conducted at the University of Florida College of Engineering.

6.2 ABET Accreditation

We would like our partner institutions to have some of the following capabilities:

- UF – COE wants to establish partnership with COE at foreign institutions with ABET accreditation or similar. Examples of these are Germany and Chile.
- Partner universities should have a common or equivalent curriculum path
- International study program participants (universities) should have an academic

profile of achievement similar (equals or exceeds) to that of the average UF-COE

- Flexibility for innovation in the program so to include international engineering study programs.
- Transfer of grades: Develop a conversion process. This is already in place at UF when receiving foreign student. It might not be true the other way around.
- Documentation: should not be a problem as arrangement should be in place with well recognized engineering programs (or ABET certified programs).

6.3 UF-COE-IEP Participation Figures

As of today, the College of Engineering has a rather small international engineering program. Recently 2 new programs have been put together, and have already started since summer and fall 2004 terms. They are the International Industrial Energy Consulting program where 6 students have already participated (summer 2004) and 2 more have been added in 2006. The other program is the Siemens International Engineering, in which 3 students started the program in 2004, and about 5 will start during summer 2005 going directly to Germany. In addition, UF-COE is directing Ph.D. thesis inVenezuela, Colombia, Chile, and 14 visiting faculty from Jamaica, Venezuela, Colombia, Peru and Chile. In addition, specific agreements have been signed between Departments of Mechanical Engineering with Escuela Superior Politecnica del Litoral (ESPOL), Ecuador

7. Conclusions

We have discussed the evolution of the International Engineering Program (IEP) at the University of Florida College of Engineering. The program embraces all UF-COE departments. It emphasizes the bi-directionality of some of its programs so to attract more, good graduate students from Latin America and the Caribbean, as well as to project the UF-COE to Latin America through an IEP program. The success of the initial programs has encouraged us to continue to open doors of opportunity into the world of international engineering studies for UF-COE students, and to attract students directly or by developing long distance courses. We recognize the importance of diversity. Recent economic initiatives, including NAFTA, have truly brought Latin America to the forefront of the International marketplace.

We plan to use additional instruments to quickly show the UF-COE IEP program. They include situations in which, for example, faculty and visitors should help on this endeavor. It is desirable that, and as stated before, faculty that are planning to visit a college of engineering abroad should be kindly requested to take with them a UF-COE package specially prepared, and give it to their host(s) providing some explanation. Similarly, faculty with visitors should take a minute to provide a meeting with their chair or academic coordinator so to explain our programs to them and give them a special package that explains UF-COE International Engineering Program.

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