

Engineering Education

Balancing Generalist and Specialist Formation in Technological Carriers: a Current Challenge

BOOK OF ABSTRACTS

**March 19 to 22, 2017
Santos, Brazil**

**Edited by
Claudio da Rocha Brito
Melany M. Ciampi**



Engineering Education

Balancing Generalist and Specialist Formation in Technological Carriers: a Current Challenge

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Claudio da Rocha Brito



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IEEE WORLD ENGINEERING EDUCATION CONFERENCE – Providing Engineering Education – Balancing Generalist and Specialist Formation in Technological Carriers: a Current Challenge. Santos, 2017. v.1
36p.

BOOK OF ABSTRACTS – I IEEE World Engineering Education Conference. March 19-22, 2017. Orgs. Claudio R. Brito (ISBN 978-85-65992-66-4) & Melany M. Ciampi (ISBN 978-85-66680-66-9). Science and Education Research Council, COPEC – Santos: EDUNINE, 2017.

1. Engineering – Conference. 2. Technology – Conference. 3. Engineering Education I. BRITO, Claudio da Rocha. II. CIAMPI, Melany, M. III. Title.

CDD 370

MESSAGE FROM THE GENERAL CHAIR PROF. DR. CLAUDIO R. BRITO



I have to say that it is an honor and a privilege to be the General Chair of the **first edition** of the **EDUNINE – IEEE World Engineering Education Conference**. I am sure that it will be the first successful scientific event of IEEE Education Society in **Region 9**, Latin America.

The theme of the conference is “**Engineering Education – Balancing Generalist and Specialist Formation in Technological Carriers: a Current Challenge**”, an exciting topic that has brought a wide range of collaborations from the scientific community.

After FIE (Frontiers in Education) a very well established conference in IEEE Education Society **Region 1 to 7**; the EDUCON (IEEE Global Engineering Conference) IEEE Education Society **Region 8** that continues growing in Europe, Middle East and Africa and TALE (IEEE International Conference on Teaching, Assessment, and Learning for Engineering) in the Asia and Pacific area of the IEEE Education Society **Region 10**, EDUNINE2017 is the next successful conference held in IEEE Education Society **Region 9** Latin America.

The conference is a great opportunity to keep constant contact with colleagues from different countries and thus to provide a fertile ground for discussions and exchange of experiences so important to the development of science and technology. The ideas, opinions and professionals contributions are shown in lectures, plenary sessions, presentations of papers and workshops. The opening session counts with the participation of promoters of the event and several authorities. At the end, the closing session presents the main results of the event.

We are very proud to have the conference in such a venue, Santos in Brazil. It is an island at the seashore of São Paulo state in Brazil. Considered the cradle of Brazil's Independence, it has the biggest seaport in Latin America, besides a large number of universities and its beachfront garden with 5,335 m in length, which figures in the Guinness Book of Records as the largest beachfront garden in the world. It is a city to visit and enjoy!

The **EDUNINE2017** is hosted by the **Santa Cecilia University – UNISANTA** a prominent university in the City, providing magnificent environment for the accomplishment of the event. We are proud to organize this congress in such institution that has opened its door and providing the excellent organizing committee that has been working restless to make of this another successful congress. We could not forget to thank in special the directors of UNISANTA **Prof. Antonio Penteado e Prof. Aureo Pasqualetto**, for their efforts and great work.

The **EDUNINE2017 – 1st IEEE World Engineering Education Conference** is organized by a partnership between **IEEE Education Society** (Education Society of the Institute of Electrical and Electronics Engineers) and **COPEC** (Science and Education Research Council) and in Technical Cooperation (in alphabetical order): AAMP (Fishing Museum Friends Society), ABENC (Brazilian Society of Civil Engineers), ABENGE (Brazilian Society for Engineering Education), AENUI (Asociación de Enseñantes Universitarios de la Informática), ASEE (American Society for Engineering Education), ASIBEI (Iberian-American Association of Engineering Education)

Institutions), GCOMM (Global Congress on Manufacturing and Management), , IFEES (International Federation of Engineering Education Societies), IGIP (Internationale Gesellschaft für Ingenieurpädagogik), INTERTECH (International Council for Engineering and Technology Education), ISTECH (Iberian American Science & Technology Education Consortium), OERN (Institute of Engineers of Portugal – North Region), Porto Gente (PortFolk), RBE (Brazilian Network of Engineering), RCI (Réseau Carthagène d'Ingénierie), SBA (Brazilian Automation Society), SBC (Brazilian Computer Society), SEFI (Société Européenne pour l^a Formation des Ingénieurs), SHERO (Safety, Health and Environment World Congress), SPEE (Portuguese Society for Engineering Education), SPEED (Student Platform for Engineering Education Development), WCCA (World Council on Communication and Arts) and WCSEIT (World Council on Systems Engineering and Information Technology).

Let's not forget to thank our sponsors CNPq (National Council for Scientific and Technological Development) and CAPES (Coordination for Improvement of Personnel of Superior Level).

We thank all the participants for their collaborations and we would like to express our appreciation for the hard work of the team that helped us throughout the conference and that really cooperated for the success of the event such as the local organizing committee members and the staff.

Our deepest gratitude to all our colleagues of the IEEE Education Society Board of Governors who supported this idea to have a new conference in IEEE **Region 9**, also to the Past President Jr, **Prof. Jim Sluss**, the President Elect **Prof. Russ Meier** and also the Former Past President **Prof. Rob Reilly** as well as the Co-chairs of **EDUNINE2017 Prof. Manuel Castro**, Past President Sr., **Prof. Melany Ciampi**, General Secretary, the Technical Program Chair of **EDUNINE2017 Prof. Henrique Santos**, Vice President on Conferences and Workshops for their hard work and dedication.

So on behalf of **EDUNINE2017** Steering Committee and myself we are extremely happy to welcome and talk to all the participants of the conference and we believe that all the participants will take the best of this experience.

Thank you all.

Prof. Dr. Claudio R. Brito
EDUNINE2017 General Chair
IEEE Education Society President

MESSAGE FROM THE CO CHAIR PROF. DR. MELANY M. CIAMPI



As the Co-Chair, I want to express how we are glad that you have accepted our invitation to join **EDUNINE2017 – 1st IEEE World Engineering Education Conference**. It is certainly the first of several to come, once it is the most recent endeavor of the IEEE Education Society for its Latin America community. It has been designed and organized in order to fulfill an aspiration of many members of the IEEE Education Society in Region 9.

The accomplishment of this conference is thanks to the commitment of Board of Governors members who have dedicated time and efforts and we have to acknowledge in special these people's hard work starting with the Past President Jr., **Prof. Jim Sluss**, the President Elect **Prof. Russ Meier** and also the Former Past President **Prof. Rob Reilly** as well as the General Chair of **EDUNINE2017 Prof. Claudio Brito**, President and the Co-Chair of **EDUNINE2017 Prof. Manuel Castro**, Past President Sr, and the Technical Program Chair of **EDUNINE2017 Prof. Henrique Santos**, Vice President on Conferences and Workshops.

We could never forget to point out the host Institution **Santa Cecilia University** principally the local committee members who made a great job and we do thank in special the directors of UNISANTA as it is known **Prof. Antonio Penteado e Prof. Aureo Pasqualeto**, for their efforts and great work and for receiving the conference with open arms.

Together we all have organized an exciting conference with a wide representation of fields, specializations and interests. The program included a variety of panels and roundtables designed to present cutting-edge research and theory. This successful conference program was possible thanks to the hard work of all staff members, reviewers and the local committee. We are sure that the conference will contribute to enlighten and provide a unique experience to all who took part in the event.

EDUNINE2017 as a conference in the field of engineering and technology education will add to the scientific community for its quality and for providing an opportunity to advance communication between academics, researchers and industry. With participants from around the world scientists from the university, the industry, and young researchers will have the chance to network and exchange useful knowledge. It is another major contribution for the development and dissemination of scientific achievements for the welfare of human kind.

We are very glad to have this first edition the **EDUNINE** held in Santos, São Paulo, Brazil that is a city of history with a rich cultural heritage. It is a vibrant island; known for its beautiful 8 Km of sand in full beaches and well maintained gardens, which are home for about one hundred different birds.

For last but not least we would like to thank all authors and participants for their collaborations, for attending the conference, bringing their expertise to our gathering making it a success.

Thank you all and enjoy this historical scientific event!

Prof. Dr. Melany M. Ciampi

EDUNINE2017 Co Chair

IEEE Education Society Secretary

March 19-22, 2017, Santos, BRAZIL

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I IEEE World Engineering Education Conference

MESSAGE FROM THE CO CHAIR PROF. DR. MANUEL CASTRO



Is a great pleasure to be co-Chair of the first **EDUNINE** conference in 2017, to be held in Santos, Brazil, in March 2017. Congratulations to the other two co-Chairs, **Claudio R. Brito** and **Melany M. Ciampi**, for their support and dynamic activities to have a successful starting.

Has been a very long trip to organize and start-up this new conference of the IEEE Education Society, closing the loop of Education Society conferences in all the IEEE Regions. **EDUNINE** in the **IEEE Region 9**, Latin and South America and will yearly covering this friendly and Spanish and Portuguese speaking area.

FIE (Frontiers in Education) is well stabilized, having the 47th conference in Indianapolis, IN, USA, during next October, and we have a new internationalization action the celebration in Madrid, Spain, of the FIE 2014, starting a new five years cycle of outside United States site election (that is mainly organized the other four years in **IEEE Regions 1 to 7**).

EDUCON (IEEE Global Engineering Conference) continue his growing in the eight edition in Athens in April, 2017, and covering **IEEE Region 8** continue growing in Europe, Middle East and African colleagues friendly meeting every year.

TALE (IEEE International Conference on Teaching, Assessment, and Learning for Engineering) faces the stabilization in this sixth edition next December 2017 in Hong Kong again, city where born 6 years ago, and shows the brilliant future of the Far East Pacific area of the **IEEE Region 10**.

And now **EDUNINE (IEEE World Engineering Education Conference)** our new and starting conference in **IEEE Region 9**, where will be a pleasure to receive your ideas, submissions, technical papers as well as to have the best networking of our Engineering Education community around the world.

Thanks to all of our colleagues of the Board of Directors of the IEEE Education Society to believe in this idea to have a new conference in IEEE Region 9, as well as to the Past President Jr, **Jim Sluss** and to the Past Vice President on Conferences and Workshops, **Russ Meier**, that both bring their experience and time to have a new conference from Brazil to Latin and South America.

Prof. Dr. Manuel Castro, IEEE Fellow
EDUNINE2017 Co-Chair
IEEE Education Society Past President, Sr.

MESSAGE FROM THE TECHNICAL PROGRAM CHAIR
PROF. DR. HENRIQUE D. SANTOS



Dear Member of the EDUNINE Community,

The **1st IEEE World Engineering Education Conference – EDUNINE2017** – will take place in Santos, S. Paulo, Brazil. On behalf of the Scientific Committee it is a great pleasure to welcome you to this event and to share the community latest achievements, findings and innovations.

The conference is one of the flagship **EDUNINE**'s conferences, organized within the framework of IEEE Region 9, addressing topics ranging from teaching and learning engineer competencies in different contexts, to exploration of innovative technologies for education support, as well as formal aspects of engineering education policies, administration and curricula. With your help we aim to make **EDUNINE** a world leading event, sharing the latest research results in this area.

We face a world of technological innovation that constantly challenges our capacity to effectively and efficiently develop the skills required to engineer proper and safe systems. Additionally, social habits, mainly pushed by mobile and ubiquitous technologies, are changing the way learners, educators and employers perform their functions and interactions aiming to the same global objective: better engineers, for a better world.

Responding to suggestions from the scientific community, the **EDUNINE** Conference program addresses these challenges with the adaptation of the topical structure to the latest developments and trends. To accomplish a more effective sharing of good practices, we have prepared also some workshops devoted to more objective issues and promoting group discussions.

Recognizing the high scientific level of this conference, all submitted final papers will be coded by a digital identifier (DOI code) and those exposed to plenary, oral and visual presentations will be indexed by IEEEExplore, which will increase the visibility of those papers and the conference. To guarantee the scientific quality of the program, each abstract was scored by three independent reviewers, and each final paper was scored by a minimum of four expert reviewers, before the topic organizers select the plenary, oral and visual presentations. Excellence, novelty and scope for innovation were the strict criteria for paper selection.

I am looking forward to meeting you in Santos to present, follow and discuss the latest trends and developments in Engineering Education field.

Prof. Dr. Henrique Santos
EDUNINE2017 Technical Program Chair
IEEE Education Society VP for Conferences and Workshops

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Engineering Education

Balancing Generalist and Specialist Formation in Technological Carriers: a Current Challenge

March 19 to 22, 2017
Santos, Brazil

PROGRAM

Edited by
Claudio da Rocha Brito



EDUNINE2017 – PROGRAM AT GLANCE

Time	Sunday 19	Monday 20	Tuesday 21	Wednesday 22	Time
8:30 am 9:00 am	Free	Registration	Registration	Registration	8:30 am 9:00 am
9:00 am 9:30 am		Opening Session	Technical Session I	Technical Session V	9:00 am 9:30 am
9:30 am 10:00 am		Plenary Session I			9:30 am 10:00 am
10:00 am 10:30 am					10:00 am 10:30 am
10:30 am 11:00 am		Coffee Break	Coffee Break	Coffee Break	10:30 am 11:00 am
11:00 am 11:30 am		EDUNINE Steering Committee Meeting	Panel	Technical Session II	Technical Session VI
11:30 am 12:00 pm			11:30 am 12:00 pm		
12:00 pm 12:30 pm	Award Session		12:00 pm 12:30 pm		
12:30 pm 1:00 pm	Lunch Break (on your own)	Lunch Break (on your own)	Lunch Break (on your own)	Lunch Break (on your own)	12:30 pm 1:00 pm
1:00 pm 1:30 pm					1:00 pm 1:30 pm
1:30 pm 2:00 pm					1:30 pm 2:00 pm
2:00 pm 2:30 pm		Plenary Session II	Technical Session III	Technical Session VII	2:00 pm 2:30 pm
2:30 pm 3:00 pm	Plenary Session III	2:30 pm 3:00 pm			
3:00 pm 3:30 pm	Plenary Session IV	3:00 pm 3:30 pm			
3:30 pm 4:00 pm	Plenary Session V	3:30 pm 4:00 pm			
4:00 pm 4:30 pm	Coffee Break	Coffee Break	Coffee Break	Coffee Break	4:00 pm 4:30 pm
4:30 pm 5:00 pm	Workshop	Plenary Session VI	Technical Session IV	Closing Session	4:30 pm 5:00 pm
5:00 pm 5:30 pm		Plenary Session VII			5:00 pm 5:30 pm
5:30 pm 6:00 pm		Plenary Session VIII			5:30 pm 6:00 pm
6:00 pm 6:30 pm	Cocktail Party	Free	Free	Free	6:00 pm 6:30 pm
6:30 pm 7:00 pm					6:30 pm 7:00 pm
7:00 pm 7:30 pm					7:00 pm 7:30 pm
7:30 pm 8:00 pm					7:30 pm 8:00 pm
8:00 pm 8:30 pm	Free		Banquet (for adhesion)		8:00 pm 8:30 pm
8:30 pm 9:00 pm					8:30 pm 9:00 pm
9:00 pm 9:30 pm					9:00 pm 9:30 pm
9:30 pm 10:00 pm					9:30 pm 10:00 pm

SUNDAY – MARCH, 19

The conference will happen in the Universidade Santa Cecília – UNISANTA, Rua Oswaldo Cruz, 277 - Boqueirão. CEP 11.045-907. Santos – SP. The GPS coordinates are 23°57'51.3" S and 46°19'15.7" W (-23.964247, -46.321022). Tel.: +55-13-3202.7100.

11:00 am – 12:30 pm

EDUNINE STEERING COMMITTEE MEETING

This meeting is only for the board of EDUNINE.

12:30 pm – 2:30 pm

LUNCH BREAK

(On your own)

2:30 pm – 6:00 pm

WORKSHOP

THE EMERGENCE OF NEW (CYBER) SCIENCES

Prof. Henrique M D Santos, Centro ALGORIMTI, University of Minho, Portugal
Teresa P. Bernardino, Centro ALGORITMI, Instituto Politécnico de Viena do Castelo,
Portugal

6:00 pm – 8:00 pm

COCKTAIL PARTY

All the participants are welcome to join us for the “Cocktail Party” on Sunday at 6:00 pm. It is the opportunity to get in touch with other colleagues and make new friends in a pleasant cultural environment.

MONDAY – MARCH, 20

8:30 am – 5:30 pm

REGISTRATION

9:00 am – 9:30 am

OPENING SESSION

Chair: **Prof. Dr. Claudio R. Brito** – General Chair of EDUNINE2017

Prof. Dr. Melany M. Ciampi – Co Chair of EDUNINE2017

Prof. Dr. Manuel A. Castro – Co Chair of EDUNINE2017

Prof. Dr. Henrique D. Santos – Technical Program Chair of EDUNINE2017

9:30 am – 10:30 am

PLENARY SESSION I

ENGINEERING EDUCATION – BALANCING GENERALIST AND SPECIALIST FORMATION IN TECHNOLOGICAL CARRIERS: A CURRENT CHALLENGE

Chair: **Prof. Dr. Claudio R. Brito** – President of IEEE Education Society

Speaker: **Prof. Dr. Melany M. Ciampi** – General Secretary of IEEE Education Society

10:30 am – 11:00 am

COFFEE BREAK

11:00 am – 12:00 pm

PANEL

LATIN AND AMERICAN PERSPECTIVES ON THE COMPUTER ENGINEERING (CE2016) REPORT

Prof. Dr. John Impagliazzo, Prof. Dr. Russ Meier, Prof. Dr. Renzo Angles, Prof. Dr.

Daltro José Nunes, Prof. Dr. Ignacio Trejos

Chair: **Prof. Dr. John Impagliazzo** – Professor Emeritus, Hofstra University and IEEE Life Fellow

12:00 am – 12:30 pm

AWARD SESSION

This is the time that we recognize the valuable accomplishments of peers who worked hard for science, technology and education.

12:30 pm – 2:00 pm

LUNCH BREAK

(On your own)

2:00 pm – 2:30 pm

PLENARY SESSION II

EDUCATION AND NEW TECHNOLOGIES – A PROPOSAL FROM AUGÉ TO THE WORLD

Chair: **Prof. Dr. Melany M. Ciampi** – General Secretary of IEEE Education Society

Speaker: **Prof. Dr. Manuel A. Castro** – Past President Sr of IEEE Education Society

2:30 pm – 3:00 pm

PLENARY SESSION III

FIRST YEAR STUDENT CAREER CONFERENCE TO PROMOTE ADVISING

Chair: **Prof. Dr. Barbara V. Bernal** – ASEE Zone II General Chair

Speaker: **Prof. Dr. Dan D. Budny** – ASEE North Central Section Chair

3:00 pm – 3:30 pm

PLENARY SESSION IV

CURIOUS SOFTWARE ENGINEERING EXPERIENCE

Chair: **Prof. Dr. Dan D. Budny** – ASEE North Central Section Chair

Speaker: **Prof. Dr. Barbara V. Bernal** – ASEE Zone II General Chair

3:30 pm – 4:00 pm

PLENARY SESSION V

**SELF-ORIENTED LEARNING BASED ON INTELLIGENT SYSTEMS INTO THE
WORKPLACE**

Chair: **Prof. Dr. James Wolfer** – Professor of Indiana University South Bend

Speaker: **Prof. Dr. Henrique Santos** – IEEE Education Society VP for Conferences and
Workshops

4:00 pm – 4:30 pm

COFFEE BREAK

4:30 pm – 5:00 pm

PLENARY SESSION VI

**USING A RESEARCH PROJECT AS CLASSROOM SUPPORT. THE CASE OF
DIGITAL PRESERVATION OF DEGRADED HISTORIC MANUSCRIPTS AT THE
SCHOOL OF ENGINEERING IN THE BUENOS AIRES UNIVERSITY**

Chair: **Prof. Dr. Maria Feldgen** – Local Chair of EDUNINE2018

Speaker: **Prof. Dr. Osvaldo Clua** – Local Chair of EDUNINE2018

5:00 pm – 5:30 pm

PLENARY SESSION VII

**EMBEDDING A SENSE OF HISTORY IN THE COMPUTING CURRICULUM:
HISTORIC INFLUENCES ON A CUSTOM CPU INSTRUCTION SET**

Chair: **Prof. Dr. Osvaldo Clua** – Local Chair of EDUNINE2018

Speaker: **Prof. Dr. James Wolfer** – Professor of Indiana University South Bend

5:30 pm – 6:00 pm

PLENARY SESSION VIII

**“24 HOURS OF INNOVATION” – A REPORT ON STUDENTS’ AND TEACHERS’
PERSPECTIVES AS A WAY TO FOSTER ENTREPRENEURSHIP COMPETENCES
IN ENGINEERING**

Chair: **Prof. Dr. Henrique Santos** – IEEE Education Society VP for Conferences and
Workshops

Speaker: **Prof. Dr. Alejandro Adorjan** – Professor of Universidad ORT Uruguay

TUESDAY – MARCH, 21

8:30 am – 5:30 pm

REGISTRATION

9:00 am – 10:30 am

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Chairs

Osvaldo Clua

María Feldgen

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10:30 am – 11:00 am

COFFEE BREAK

11:00 am – 12:30 am

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12:30 pm – 2:00 pm

LUNCH BREAK

(On your own)

2:00 pm – 4 :00 pm
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Chairs

Dan Budny
Barbara Bernal

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COFFEE BREAK

4:30 pm – 6:00 pm

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Chairs

Alejandro Adorjan
Eduardo Francisco Torres Puente

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Pedro Henrique Oliveira Silva, Alex Vitorino, Erivelton Geraldo Nepomuceno, Samir Angelo Milani Martins29

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Fernando Martell Chavez, Eduardo Francisco Torres Puente30

8:00 pm – 11:00 pm

THE BANQUET

Farwell dinner is a way to close the successful event accompanied by the colleagues in a nice and beautiful environment. The tickets will be available at the reception desk.

WEDNESDAY – MARCH, 22

8:30 am – 3:30 pm
REGISTRATION

9:00 am – 10:30 am
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Chairs

Melany M. Ciampi
James Wolfer

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COFFEE BREAK

11:00 am – 12:30 am
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Chairs

Miguel Nuñez del Prado
Ana Luna

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LUNCH BREAK
(On your own)

2:00 pm – 4:00 pm
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Bradley Trowbridge
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4:00 pm – 4:30 pm
COFFEE BREAK

4:30 pm – 5:00 pm
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Chair: **Prof. Dr. Claudio R. Brito** – General Chair of EDUNINE2017
Prof. Dr. Melany M. Ciampi – Co Chair of EDUNINE2017
Prof. Dr. Manuel A. Castro – Co Chair of EDUNINE2017
Prof. Dr. Henrique D. Santos – Technical Program Chair of EDUNINE2017

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WORKSHOP

THE EMERGENCE OF NEW (CYBER) SCIENCES

Henrique D. Santos, Teresa P. Bernardino

Frequently, when some new problems arise within our civilization development process, the same question comes up: is this science, or not? The answer is particularly critical for engineer careers, since they are typically supported by well-organized and robust Bodies of Knowledge (BoK), essential to develop and deploy system models with a predictable behavior, which is a main characteristic of mature sciences. Furthermore, most of the time those system deal with critical resources interfering with our daily lives, both directly or indirectly, but frequently in a ubiquitous and unperceivable mode. This is what happens now with Cyberspace and its different applications to several aspects of social, medical, governmental and economical (among others) applications. In this workshop we will debate different aspects of science construction and evolution towards professions, focusing in engineering and using as case study the Cybersecurity area.

PANEL

LATIN AND AMERICAN PERSPECTIVES ON THE COMPUTER ENGINEERING (CE2016) REPORT

John Impagliazzo, Russ Meier, Renzo Angles, Daltro José Nunes, Ignacio Trejos

ACM and the IEEE Computer Society have released their computer engineering curriculum guidelines in December of 2016. The curricular report, tagged CE2016, reflects current computer engineering education and practice that would be relevant for the coming decade. The report provides some examples on ways to map knowledge units to courses and it addresses expected requirements in science and mathematics. This panel presentation provides an overview of the report and aims to provide perspectives on computer engineering from diverse Latin American communities. The authors plan to engage in discussions with participants that contrast CE2016 with current computer engineering curricula in Latin America. They also provide ways to implement the guidelines within Latin American settings. The authors welcome full audience participation including overall comments with the goal of cultivating robust computer engineering educational models that complement academic and industry communities. The session should prove to be very timely and highly informative.

PLENARY SESSIONS

ENGINEERING EDUCATION – BALANCING GENERALIST AND SPECIALIST FORMATION IN TECHNOLOGICAL CARRIERS: A CURRENT CHALLENGE

Claudio R. Brito, Melany M. Ciampi, Manuel A. Castro, Henrique D. Santos, Victor A Barros

The purpose of this paper is to present the new IEEE Education Society Conference in its Region 9, Latin America, the IEEE World Engineering Education Conference – EDUNINE2017. Its first edition is in Santos, São Paulo, Brazil, an important city for its characteristics and history. It is a historical conference that has been designed to happen in the next years, in the different countries of Latin America that encompasses a vast and very diverse area of the world, multicultural and multilingual. It is a unique and innovative congress that brings decision makers, researchers and academics from many countries together, for a lively exchange of ideas and research related to the development and sustainability of Engineering Education quality and related subjects. It offers unparalleled networking opportunities with peers worldwide, keynote speakers, international perspectives on engineering education and not to mention the value in meetings that comes from the human-to-human connections that occur.

EDUCATION AND NEW TECHNOLOGIES – A PROPOSAL FROM AUGE TO THE WORLD

Manuel A. Castro, Miguel Angel Pavon, Santos Pavon

We presented in 2016 a new curricular online education modules oriented to the improvement and engagement of new professionals literacy worldwide (and mainly in Spanish speaking countries) oriented to the generalized use of New Technologies inside the practice work in and outside the classroom. The main project name is CRECe, and inside it there are four areas: (i) Pedagogy, (ii) Science Didactics, (iii) New Technologies applied to Education, and (iv) General Competences. We will navigate inside the area of the "New Technologies applied to Education" the process of the development of the modules included as well as the main methodology orientation in the delivery of each course as well as the synergy of all the area. Some of the modules are starting their delivery in the last quarter of 2016 and the rest will be delivered successive during 2017. <http://auge.edu.es/crece/>

FIRST YEAR STUDENT CAREER CONFERENCE TO PROMOTE ADVISING

Dan Budny, Beth Newborg

Our data shows that over the past 15 years over 75% of the entering first year students change their selected major between the start of classes in August and the time they need to register for the second year classes in March. This movement of students has many impacts on student retention and on students' success across 4 years of engineering education. To help improve the retention of engineering students in the freshman year — thus positively

impacting students' ongoing success – we created a number of writing assignments in the first year Introduction to Engineering course to combat facilitate students' choosing their majors wisely during or immediately after the freshman year. These writing assignments were designed to engage students in researching various crucial aspects of the field of engineering in which they were interested.. Despite our efforts to have students research and write about various aspects of a particular engineering field, many of the students just did not take the assignments seriously; as a result they did not get the full benefit of the assignment. To encourage the students to put more effort into the assignments, we created the Freshman Career Conference. The conference is a Saturday event, modeled after career-oriented events and conferences held at student professional conferences and conventions held by organizations such as the Society of Women Engineers, National Society of Black Engineers and Society of Hispanic Professional Engineers. For our Freshman Career Conference, we brought in practicing engineers from Pennsylvania corporations; these engineers talked to students about their education and their work; gave professional development workshops; and spoke to students and students about the importance of beginning their career development plans now as freshman. This paper discusses the factors around creating such a conference and the impact it has made.

CURIOUS SOFTWARE ENGINEERING EXPERIENCE

Barbara Bernal

Currently it is paramount for software engineers to develop the skills and background necessary to effectively work, communicate and innovate on an international scale. Our growing global world needs an increasingly diverse workforce. The effects of the globalization have been felt in the software engineering arena through software engineering projects realized by diverse professionals located in different continents with different industrial background, culture, time zone, and even language. During 2014 and 2015, Kennesaw State University (KSU) faculty from Marietta, GA, USA traveled to La Salle University in Arequipa, Peru to deliver special Software Engineering (SWE) winter programs. The programs provided opportunities to study the student's understanding of software engineering terms, knowledge, and practices in two different international arenas, KSU and La Salle. This paper discusses details and results of the winter programs executed by KSU bi-lingual faculty to La Salle participants with limited English understanding. A cycle of knowledge building emerged from the two cultures in the preparation and execution of the courses. The student participants aligned their knowledge and understanding of their Latin American software engineering practices to the new perspective given in the program. The experience educated faculty and participants of the agreements, differences, and challenges to the software architecture and game development curriculum, terminology, and development trends. The process of the collaborative knowledge distribution and assimilation that was built and experienced in the courses was surveyed with the student's views about pre-understandings, personal comprehension, opinions and final assimilation of the course content.

SELF-ORIENTED LEARNING BASED ON INTELLIGENT SYSTEMS INTO THE WORKPLACE

This work aims to purpose the creation of a model to develop intelligent learning systems with self-regulated contents. Its main goal is to support self-oriented learning in workplace, to improve performance levels and competencies. Our target is mainly software industries, where the novelty of knowledge and learning needs are critical success factors for the companies' competitiveness and the learning cycles are being shortened. Learning in workplace environment is a recent research phenomenon, which has been taking place along with the evolutionary trend of e-Learning. The innovative component is based on technological and behavioral standards arising mainly from the Social Semantic Web. To approach these challenges one main issue is to find out if the organization's intrinsic knowledge is recognized and organized. Besides, organizations also need to recognize the practical use of this kind of systems. Both issues have been surveyed in a case study.

USING A RESEARCH PROJECT AS CLASSROOM SUPPORT. THE CASE OF DIGITAL PRESERVATION OF DEGRADED HISTORIC MANUSCRIPTS AT THE SCHOOL OF ENGINEERING IN THE BUENOS AIRES UNIVERSITY

Oswaldo Clua, Maria Feldgen

The last 20 years we have been developing a project on digital preservation of degraded historic handwritten documents in cooperation with the "Ravignani Institute" devoted to Latin American history research. This projects objective was the research and development of algorithms, tools, models and workflow to extract information from the images. This information was used to generate descriptive metadata and to provide a structured access to the historic archive. During the time we worked in the project, we decided to include the experiences and a reduced complexity version of the required tasks in the subjects we and other colleges are in charge at our University. This incorporation is in addition of using the project as a source of thesis and final work assignments. In the paper we will detail parts of the project and the modification of some tasks and requirements done to make them suitable as learning challenges.

EMBEDDING A SENSE OF HISTORY IN THE COMPUTING CURRICULUM: HISTORIC INFLUENCES ON A CUSTOM CPU INSTRUCTION SET

James Wolfer

History can serve as a connecting thread bonding students to their professional community and intellectual heritage. Many STEM disciplines, such as physics and biology, consistently integrate historic figures into the curriculum. Computer Science, on the other hand, often omits history from the instructional landscape. As a step to mitigate the situation, this work explores some of the historic design influences behind a custom, robot enabled, CPU and corresponding instruction set. The CPU design has been the basis for student-implemented emulators to control robots in a Computer Organization course. By featuring a sampling of the men, women, machines, and instruction sets from history we provide a design context for the custom CPU. Knowing this history may help students develop a sense of why things work

the way they do in modern computers, as well as instilling a sense of the enormous contribution pioneering men and women have made to their discipline.

“24 HOURS OF INNOVATION” – A REPORT ON STUDENTS’ AND TEACHERS’ PERSPECTIVES AS A WAY TO FOSTER ENTREPRENEURSHIP COMPETENCES IN ENGINEERING

Alejandro Adorjan, Gerardo Matturro

At university level particularly in Engineering fields, the academe shows significant enthusiasm for the development of various competencies concerning entrepreneurship and innovation, focusing on the promotion of opportunities and the strengthening of the existing connection between the University and the Software Industry. One of the main challenges in Engineering is finding a proper answer to the following research question: Which entrepreneurial competencies should we foster in our students if they are to emerge from the Educational system into the International Software Industry? The present work presents a group of students’ perspectives on their perception of Innovation and Entrepreneurship. The surveyed group (freshmen Software Engineering students) participated in the 24-hour national contest on Innovation, winning the first place amongst 200 students, businessmen and professionals.

TECHNICAL SESSIONS

AN APPROACH TO INFORMATICS FORESIGHT

María Hallo, Francisco Hallo

Most curricula in Informatics and other sciences at the universities are in permanent change. An informatics foresight is useful to update the study pensa and to develop and offer new study curricula tuned for the local needs. More of this types of studies are developed by governmental departments and specialized groups because of the number of variables to analyse, the complexity of scenarios, and the wide number of experts needed, not to mention the cost and the governmental plans and goals a country has. In this paper we have adapted a short method to define an informatics foresight using the information already available in internet and specialized electronic libraries. The method was applied to a study case: the future of the informatics and computer science mayors at Escuela Politécnica Nacional of Quito Ecuador.

EXPERIENCES USING THE JIGSAW LEARNING TECHNIQUE TO TEACH IFPUG FUNCTION POINTS

Jose Antonio Pow-Sang

IFPUG function point (FP) is a technique that is utilized to measure the functional size of a software system. This paper presents experiences of the utilization of the Jigsaw learning technique to reinforce the theoretical concepts about FP taught in a previous traditional

lecture class. In the first experience with Jigsaw, students had some misconceptions about the FP measurement process after the class due to the design of the class. After the first experience, Jigsaw class was modified to avoid student's misconceptions originated by the design of the class. Results of a pretest and a posttest applied in a class with the new design allowed us to corroborate students improved their knowledge and performance after their participation in their cooperative work.

USING PBL AND SOFTWARE ENGINEER TECHNICAL SKILLS TO MOTIVATE COMPUTER SCIENCE STUDENTS TO DEVELOP A MICROCONTROLLER CORE: THE 8051-LIKE CASE STUDY

Adriano Sena, Cristiano Alencar, Péricles Sobreira, Jauberth Abijaude

A new market of electronic products has arisen due a growing demand on portable, ergonomic and small embedded devices. The technology related to the development of such devices allows high integration of silicon complex systems from the construction of several hundred thousands of transistors in one only chip (System-on-Chip – SoC). However, we can realize there is a discrepancy between such transistors integration capacity and the processes applied to the development of such systems, and this fact motivated the proposal of this research paper: a work developed by two Computer Science undergraduate students from the utilization of PBL (Project-Based Learning) as a motivational technique and some methodologies / languages / technologies into a framework combining UML, SystemC and ipPROCESS to make SoC construction processes more fluid. The proposed framework is used to model as case study an 8051-like microcontroller.

CHALLENGES IN DESIGNING CYBER SECURITY & DEFENSE CURRICULUM

Teresa P. Bernardino, Henrique D. Santos

It has been noticed recently an increase number of cyber-incidents, sometimes causing seriously impact to organizations and governments. Cyberattacks exploits a variety of technological and social methods to achieve a malicious objective. The emergence of new and sophisticated cyber threats demand very skilled operatives with a solid knowledge about concepts and technologies related to cyber security/defense, to protect critical assets. However, the landscape of these base knowledge is very diverse in nature, requiring agile learning methods, besides a very demanding training process limited by the intrinsic technology's complexity. Although existing cybersecurity and defense curricula spans a wide array of topics and training strategies, its programs content lack focus on some particular aspect, like depth of education/training and its link to professional development. This paper intends to provide some reflections regarding the curricula contents that should be considered when a graduate level curriculum is designed.

LEARN-BY-DOING-COLLABORATIVELY ACROSS THE CURRICULUM: INTEGRATIVE PROJECTS AT UCENFOTEC

Projects appear rather late in Computing and Engineering curricula: typically as ‘capstone’ at the end of a Bachelor’s degree, sometimes in a two-semester sequence. There are alternatives: since its inception in September 2000, Costa Rica’s UCenfotec offers Computing-related curricula with a ‘backbone’ of three or four integrative projects, in which students learn to work collaboratively in teams with defined roles and processes, which vary according to their curriculum level. There, students acquire new knowledge and combine it with previous learnings in order to perform technical activities. They also learn: 1) to work as teams using systematic engineering processes relevant to their Computing sub-discipline; 2) to communicate effectively; 3) to be accountable as a team and individually (according to their role); 4) to research and apply diverse technologies; 5) to effectively manage individual and team work, and 6) to critically evaluate the artifacts of the process. Processes vary according to the main subject matter of the Computing specialty. In each curriculum, the projects form a sequence of incremental ‘stepping stones’ distributed in the span of nine terms, in which students experience learn-by-doing-collaboratively technological artifacts of increasing complexity, difficulty, diversity, heterogeneity and realism, where ‘hard skills’ are intermingled with ‘soft skills’ that develop from the individual to the collective, each member growing in autonomy and responsibility, via experience-based learning.

PEDAGOGICAL PROPOSAL FOR THE DISCIPLINE OF EDUCATIONAL INFORMATICS: SEARCH OF LITERACY

Douglas Ropelato, Elcio Schuhmacher, Vera Rejane Schuhmacher

Globalization, social networks, geolocation ... are terms that permeate our lives, no longer as simple concepts described in textbooks, but as a *modus operandi*. Children ask for gift screens, the era of touch screens begins. In this context, a research was developed in the Postgraduate course in Natural Sciences and Mathematics, at the Regional University of Blumenau - FURB, with the general objective of creating a pedagogical proposal for the discipline of Educational Informatics. The discipline's conception is to develop the skills and competences of: - media literacy, which seeks to understand the role and functions of the media, discuss the skills of its users with the aim of producing content; - information literacy that develops skills and abilities based on the ethical use of information, as well as its location, access, communication and processing.

COMPARISON OF APPLICATIONS FOR EDUCATIONAL DATA MINING IN ENGINEERING EDUCATION

Diego Buenaño Fernández, Sergio Luján-Mora

Currently there are many techniques based on information technology and communication aimed at assessing the performance of students. Data mining applied in the educational field (educational data mining) is one of the most popular techniques that are used to provide feedback with regard to the teaching-learning process. In recent years there have been a large number of open source applications in the area of educational data mining. These tools have facilitated the implementation of complex algorithms for identifying hidden patterns of

information in academic databases. The main objective of this paper is to compare the technical features of three open source tools (RapidMiner, Knime and Weka) as used in educational data mining. These features have been compared in a practical case study on the academic records of three engineering programs in an Ecuadorian university. This comparison has allowed us to determine which tool is most effective in terms of predicting student performance.

ANALYSIS OF DATA MINING TOOLS APPLIED TO LMS FOR PERSONALIZED EDUCATION

William Villegas-Ch, Sergio Luján-Mora

The evolution of higher education focuses largely on online learning through the use of the learning management system (LMS). Data from the LMS can be evaluated using educational data mining (EDM). The EDM allows to convert the data obtained from the various activities of a course into useful information. This information can be analyzed to address questions that aim to find learning differences among students. These differences can be harnessed to offer a personalized education adapted to their learning styles. This approach seeks to improve the efficiency of e-learning, recognizing patterns in student performance that help develop a personalized education. This paper presents an analysis of EDM tools applied to a case study in the e-learning platform Moodle. The objective is to investigate the information to estimate the student's cognitive profiles from the data collected. These profiles will contribute to knowledge as personalized learning objects.

USE OF SIMULATION SOFTWARE TO ENHANCE STUDENT CREATIVITY AND INNOVATION IN ENGINEERING AND TECHNOLOGY PROGRAMS

Ali Eydgahi

From educational standpoint, the modeling and design of a complex product or system is an ideal activity for learning by doing. In such activity, student teams design and simulate a complex engineering systems by applying principles of physical science, mathematics, computer science, engineering and technology. To complete such activity in electrical engineering and technology field, students must integrate knowledge gained from different classes such as circuits, controls, signals and systems, instrumentations, computer programming, mathematics, and engineering mechanics. The completion of such activity involves simulation of significant hardware parts that should be integrated with software to create a virtual system. For simulating an engineering product such as an unmanned vehicle or robot, students need to become familiar with operation and specification of different hardware such as a variety of sensors, wireless digital camera, and remote control systems. The students also get exposed to sophisticated systems such as path planning systems, motion planning systems, obstacle avoidance systems, vision systems and feedback control systems. Implementation and simulation of such a system require creativity and innovation and the challenging nature of the activity generates excitement and motivation for students. At the same time, it helps students gain experience working in interdisciplinary teams and learn the importance of technical communication and sharing their ideas. Meanwhile, faculty member's engagement will assist student to develop their own ideas and views with comprehensive design activities. The simulation of an unmanned vehicle or a robot can be a

very beneficial projects for design capstone courses or undergraduate research projects. In this paper, a successfully simulated and animated design modules for an unmanned Ariel vehicle and also industrial robot Structure using Presys and NISA Software are presented. The main goal of this project was to develop a number of educational modules that provide simulation of all parts of an unmanned Ariel vehicle and an industrial robot for undergraduate engineering and technology courses.

MODELING A MOBILE LEARNING CONTEXT DATA ONTOLOGY

Arthur Casals, Anarosa Brandão

One of the aspects brought by the use of connected mobile devices in education is the possibility of learning in different environments, using physical environmental factors in its advantage. These factors are part of what we define as “mobile context”, which is comprised by different information dimensions: temporal, physical, and social. This information can be modeled as an ontology and used in conjunction with existing pedagogical methodologies and educational content to enhance the learning process. In this paper we propose ontologies to represent mobile context data and learning objectives. The former represents the dimensions involved in a virtual learning environment accessed by a mobile device and the latter represents learning objectives as part of pedagogical methodologies. They are combined with an existing educational content ontology to establish an information structure to be used by virtual learning environments when accessed from mobile devices. A scenario of application is also provided.

A VISUAL CHAOTIC SYSTEM SIMULATION IN ARDUINO PLATFORM CONTROLLED BY ANDROID APP

Pedro Henrique Oliveira Silva, Alex Vitorino, Erivelton Geraldo Nepomuceno, Samir Angelo Milani Martins

The application of computer and electronic technologies has grown extensively in recent years being a useful tool for teaching in various fields of knowledge. The use of these technologies aims at bridging the gap between theory and practice, improving learning outcomes. This work demonstrates the project of didactic prototype based on the Arduino platform to study and teach nonlinear dynamical systems and their recent concepts discussed. The teaching platform presented here aims for visual effects, provide a better understanding of basic concepts of nonlinear dynamical systems, such chaos. It is also demonstrated when the data loses the precision, also in a visual setup. Additionally, input data may be configured by wireless communication, which makes very attractive for young students.

LEARNING DATA ANALYTICS THROUGH A PROBLEM BASED LEARNING COURSE

Miguel Nuñez del Prado, Rosario Gomez

Problem or Project Based Learning (PBL) is a student-centered teaching method. The idea behind this methodology is to teach technical as well as managerial skills by resolving problems or accomplishing projects. In the present effort, we present an instance of PBL applied to Web and Data mining courses for Information Engineering students. We describe the analysis, design, implementation, evaluation and visualization of a Web mining platform as well as of library analysis system. These projects concern the Web Analytics and Data Mining courses, respectively. The former provides students the opportunity to develop a real project ranging from data acquisition, from a Web site, data storing, analytics and visualization. The later course furnishes a framework to learn and to apply the Knowledge Data Discovery (KDD) methodology over a library dataset to profile customers and understand business dynamics. In both courses, students are confronted to handle big amounts of heterogeneous data.

IMPROVING THE FEASIBILITY ANALYSIS OF ENERGY EFFICIENCY PROJECTS BY COMPARATIVE COST ANALYSIS AND IDENTIFYING MEASURING AND VERIFICATION METHODOLOGY

Fernando Martell Chavez, Eduardo Francisco Torres Puente

Most energy efficiency projects rely on capital investment and must compete with other capital expenditure projects inside organizations. Feasibility analysis of the energy efficiency or energy saving projects must be improved in order to be more attractive. One of the main objectives of energy management is cost reduction. Comparative cost analysis requires not only an initial and direct estimation of the energy savings, but a detailed analysis on the actual energy consumption and an estimation of the energy consumption for the improved scenario. For this improved scenario, additionally to power, energy and cost estimations, a reliable energy measurement and identification methodology must be determined. This paper discusses an educational approach that addresses how comparative energy cost analysis and a proper selection of energy measurements and verification methodology are both good analysis practices that present the potential of adding credibility to the feasibility studies.

A PORTABLE INTEGRATED SERVO-LAB FOR CNC TRAINING

Roberto Santiago Apostoli

A wholly designed and built portable servo-lab is described. The task is to bring an integrated training facility concerning with the computer numerical control (CNC) instruction. Main objectives are to: (i) Offer one axis CNC machine tool, resembling a real one; (ii) Make an interactive training servo-lab, mostly with mechanical components; (iii) Follow the correlation between theory and practice about open and closed controls; (iv) Install and test the up to date Linux O.S., like Ubuntu and Debian; (v) Pour these practical experiences into a low cost DVD Multimedia course; (v) Bring a “hands on” basic learning on manufacturing subjects involved digital controls, machine tools and robotics, specially to those Industrial Technical Schools which have not a CNC mill or a lathe. The blackboard, photos, films and PC simulations are good education tools. But it's necessary to acquire a deep knowledge involved by the complex multidisciplinary “Mechatronics” engineering.

WORKING WITH ENGINEERING STUDENTS AND KIDS USING ARDUINO IN A MULTIDISCIPLINARY EXPERIENCE

Rosely Campos

This is a multidisciplinary project between mechanical, mechatronic, control and automation engineering students that propose teach for kids improving the technological, programming and mathematical interest. The student prepare and implement so many different applications using Arduino in classes to kids between 06 and 15 years old. Results can be analyzed neither just with kids improvement, but in a good didactical and social students performance.

STUDY PLATFORM BASED ON ZERO-EMISSION-VEHICLES

Silvano Rossi, Marcelo Spina, María Peralta, Roberto de la Vega, Roberto Leegstra, Guillermo Santillán, Patricia Ciancio

Research and development of systems based on the utilization of clean and renewable energies, in academic world, can also leads to the implementation of multipurpose platforms as support for training in Engineering degrees, since by means of them it is possible to carry out standards applicability analysis, studies on trends and possible alternatives, modeling, design, implementation, test and utilization of new technologies. In such a context, this work presents the construction of two experimental hybrid vehicles that use photovoltaic solar energy as main electricity source. Both vehicles constitute platforms for analyzing aspects related to zero-emission concept, but fundamentally for the study, analysis and execution of practices related to power electronics, electrical machines and electrical drives, instrumentation, mechanical and structural issues, as well as the research and development in electric traction, thinking about the urban sustainable mobility.

ALTERNATIVE SETUP FOR ESTIMATING RELIABLE FREQUENCY VALUES IN A RIPPLE TANK

Ana Luna, José Luján, Luis García Mantilla, Daniel Malca, Miguel Nuñez del Prado

In this paper, we introduce an innovative, low cost and easy experimental setup to be used in a traditional ripple tank when a frequency generator is unavailable. This configuration was carried out by undergraduate students. The current project allowed them to experiment and to study the relationship between the wavelength and the oscillation period of a mechanical wave, among other things. Under this setup, students could evaluate the mechanism not only qualitative but also in a quantitative fashion with a high degree of confidence. The results obtained for the propagation speed of the mechanical waves in different media with this alternative design coincided with those acquired using a commercial device designed for this purpose.

TEACHING ELECTROMAGNETICS IN AN ELECTRICAL/ELECTRONIC ENGINEERING UNDERGRADUATE COURSE: THE HYBRID OPTION

The effective study of number of topics in Electrical/Electronic Engineering undergraduate programs is not easy to accomplish due to the efforts to understand complex mathematical equations and complicated interactions that are difficult to visualize. Teachers all around the world are realizing that the traditional “chalk and talk” teaching method is no longer effective with the new generation of digital native students. This method, that has been used for hundreds of years is proving to be ineffective results, especially when involves topics that demand 2D or 3D visualizations, like for example propagation of electromagnetic fields, antenna patterns and waveguides. This paper aims to show some new teaching processes perspectives for subjects encountered in Electrical/Electronic Engineering courses. It will present advantages and experiences between University of Nottingham (United Kingdom) and Instituto Federal de Santa Catarina (Brasil) in teaching topics related to Electromagnetics, by using a variety of simulation and visualization approaches.

THE THINKING AND PRACTICING OF THE ENGINEER IN A VERTIGINOUS CHANGING WORLD

Sergio Anauate, Ana Cristina Nogueira de Carvalho

The world accelerated changing turns the future increasingly unpredictable, asking for higher promptness and inventivity. Many new professions are popping up and we don't even know what we need to know for the coming world. Despite this, engineering still have a fundamental role in creating and constructing objects, means and processes to accomplish human needs, dreams and desires, but a new way of doing engineering is requested to face new challenges, creating new solutions for new and more complex problems, requiring adaptiveness, creativity and multidisciplinary collaborative work. The fragmented teaching, isolating the disciplines from each other does not allow the view of the broad picture. Our proposal is to introduce the first-year engineering students in activities to face this fragmentation, to fire up the creative process, stimulating the critical thinking, the learning by projects, emphasizing the value of cross-cultural and artistic knowledge and the role of heuristics in engineering.

EVALUATING THE REPRODUCIBILITY OF MULTIAGENT SYSTEMS

Alex Vitorino, Denise Resende, Erivelton Geraldo Nepomuceno, Márcio Lacerda

A multiagent system (MAS) is a computer based model of multiple interacting intelligent agents within an environment. One of the key aspects of such models is the ability to reproduce the results in different software and hardware. In general, the simulation of these models are carried out under floating point standards. It is well known that by limitation of computer arithmetic, the results may be different when the combination of hardware and software is also different. In the case, the evaluation of the reproducibility of MAS is harder than deterministic models, as it is usually seen as stochastic process. To overcome this problem, this paper presents a Kolmogorov-Smirnov test to verify if two simulations of a MAS keep the same statistical properties. Computational simulations demonstrate the efficiency of technique as tool to verify the reproducibility of a MAS.

IT SKILLS MAPPING ENGINE

Jorge Murillo, Ignacio Trejos

Costa Rica's workforce is recognized for its high educational standards, ranking 28th in the world — the highest in Latin America, the #1 outsourcing city, and the #1 exporter of high value added services — surpassing Chile, Brazil, Argentina and Peru. The Costa Rica Investment Promotion Agency (CINDE) is a not-for-profit organization promoting foreign investment in Costa Rica; it shows labor statistics grouped in four investment sectors for their 280 high-tech multinationals, but it does not provide details of actual job positions at skills levels to effectively create new educational programs, stimulate career development, onboarding and competitive IT offerings, area of high importance, especially for services companies. CINDE's IT Group (industry and academia representatives) is sponsoring a skills mapping software tool to gather job details from industry, which will be mapped through the international SFIA skills framework, the IEEE Enterprise EITBOK guide, the e-CF European e-Competence Framework and the ACM/IEEE IT2016 curriculum.

PROTOMESH, A WIRELESS SOLUTION AND PLATFORM FOR EMBEDDED EDUCATION AND RASPBERRY PI WORKSHOPS

Bradley Trowbridge, Josiah Husinger, Frank Calas, Vladislav Fomitchev, Zachary Weingarten, Ryan Integlia

In order to further education in embedded discovery, Protomesh (prototype mesh) seeks to improve the field by providing a wireless solution for deploying Raspberry Pi workshops. Protomesh is an easy to use platform for starting up a quick ad-hoc batman-adv network. Batman-adv is an open source, kernel module native to Linux that provides a layer two mesh network routing protocol. We leveraged this technology during Raspberry Pi workshops to use as a wireless infrastructure where students could freely access their Raspberry Pi across the mesh network. Network technologies such as this provide both an interactive and enriching experience. Protomesh enhances this experience by providing a solution for wireless connections and removing the burden of tethered Raspberry Pi's. By setting the workshop in this wireless mesh environment, students are allowed to explore a new horizon of embedded education. We were able to teach students about fundamental networking and routing protocols. Other activities were made possible with this mesh network such as a button ping game and GoPiGo driving games.

GROUPING STUDENTS FOR COOPERATIVE AND COLLABORATIVE LEARNING: CHALLENGES AND TRENDS IN VIRTUAL LEARNING ENVIRONMENTS

Flavius Gorgonio, Yuri Silva, Karliane Vale, Huliane Silva

Educational Data Mining is concerned with developing new methods and techniques for discovering knowledge from educational databases in order to contribute to better

understanding academic environment, and can be used to support decision making. Clustering methods has been used in educational data mining to segment classes into homogeneous and/or heterogenous groups of students. This approach improves cooperative and collaborative interactions among students and it contributes significantly to the mutual learning process. This is particularly important in a virtual learning environment, where there is no physical interaction between students, and mutual learning is through virtual interactions, chats, cooperative and collaborative activities and exercises developed in groups. This paper reviews methods and techniques used to grouping students in productive and collaborative teams and investigates challenges and trends to use these approaches in virtual learning environments.

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