Introduction and Outline of the Special Issue on Circuits and Systems Education: experiences, challenges, and views

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1. Introduction

Whether it is the power grid, the telephone network, or the chip of a microprocessor or a mobile phone, all these are some of the most complex man-made systems that affect our daily life. Yet, the basic circuits and systems methods that are crucial for the specification, design, construction, and maintenance are mostly hidden or considered to be self-evident to the wider public and even to some engineers. Hence, in electrical engineering education, the topics related to circuits and systems still should play an important role in the future. However, various current developments challenge the role of circuits and systems (CAS) and, hence, it was considered important to clarify it, learn from various examples, and devise visions for the future. All these issues were discussed during a one-day workshop in May 2008. With this special issue, we wish to share these experiences and views, stimulate further interactions and role models, and prepare plans for future cooperation.

2. Content and role of circuits and systems

It is not so easy to define what we consider by circuits and systems and this definition and scope may still be rather specific. Hence, we attempt to describe it from few perspectives. We can refer to the field of interest as stated by the IEEE Circuits and Systems (CAS) Society: “The theory, analysis, design (computer aided design), and practical implementation of circuits, and the application of circuit theoretic techniques to systems and to signal processing. The coverage of this field includes the spectrum of activities from, and including, basic scientific theory to industrial applications.” The CAS Society has 16 technical committees

working on various aspects of this mission (http://www.ieee-cas.org/). It is also interesting to look at the role of CAS from a historical perspective. We here briefly review the history of the CAS education [1] – [4]. It has been generally acknowledged that around 1930 an understanding of circuits based on mathematics and physics principles was gradually introduced in the electrical engineering curricula. It was also appreciated by industry. In 1953, Ernst Guillemin (a great educator: http://www.eecs.mit.edu/great-educators/guillemin.html) wrote [5], "linear, passive, lumped, finite, bilateral circuit theory is the electrical engineer's bread and butter. [The student] needs to know this subject before he tackles any of the other subjects in the curriculum." However, Guillemin insisted that the subject must be taught in a way that will provide a student "with basic concepts and ways of thinking that will not become obsolete throughout the rest of his undergraduate and graduate years." In 1984, Mac Van Valkenburg [6] reviewed fifty years of teaching circuits (1934–1984) by reviewing textbooks on circuits used in the USA. His paper indicated several landmark texts, such as [7], that are mathematically founded. However, reference [7] and even several updates such as [8] have been now abandoned by most schools. Of course, there are many excellent books written about basic circuit theory with slightly different flavors. However, the main ideas remain the same. Van Valkenburg's paper [6] offers no clear prediction about the next fifty years: "After more than a half century at both the undergraduate and graduate levels, it might be expected that common agreement would have been reached on what should be taught [in circuit theory]. This is not the case at all, as you must know. A new approach might appear tomorrow and sweep the field. Surely some future treatments will make the use of the computer and offer courseware. With this uncertainty, we have to face the next half century". Today, almost 25 years after this statement was made, we can confirm that there has been no such sweeping view in the field. The role of computers and computer aided design has indeed pervaded, but has not reversed the field of circuits and systems. In the frequently referred Circuits and Filters handbook [9], edited by W.K. Chen, a comprehensive overview of this field is given in thirteen parts that are outlined here. Such an enumerative list gives a detailed atomic view on the individual topics that may be covered in various courses and trajectories of education at various places.

PART I, MATHEMATICS: Linear Operators and Matrices, Bilinear Operators and Matrices, The Laplace Transformation, Fourier Series, Fourier Transforms and the Discrete Fourier Transform, z-Transform, Wavelet Transforms, Graph Theory, Signal Flow Graphs, Theory of Two-Dimensional Hurwitz Polynomials
PART II, CIRCUIT ELEMENTS, DEVICES AND THEIR MODELS: Passive Circuit Elements, RF Passive IC Components, Circuit Elements, Modeling and Equation Formulation, Controlled Circuit Elements, Bipolar Transistors (BJT) Circuits, Operational Amplifiers, High-Frequency Amplifiers
PART III, LINEAR CIRCUIT ANALYSIS: Fundamental Circuit Concepts, Network Laws and Theorems, Kirchhoff's Voltage and Current Laws, Network Theorems, Terminal and Port Representation, Signal Flow Graphs in Filter Analysis and

Synthesis, Analysis in the Frequency Domain, Tableau and Modified Nodal Formulations, Frequency Domain Methods, Symbolic Analysis, Analysis in the Time Domain, State-Variable Techniques

PART IV, FEEDBACK CIRCUITS: Feedback Amplifier Theory, Feedback Amplifier Configurations, General Feedback Theory, The Network Functions and Feedback, Measurement of Return Difference, Multiple-Loop Feedback Amplifiers

PART V, NONLINEAR CIRCUITS: Qualitative Analysis, Synthesis and Design of Nonlinear Circuits, Representation, Approximation and Identification Transformation and Equivalence, Piecewise-Linear Circuits and Piecewise, Linear Analysis Simulation, Cellular Neural Networks, Bifurcation and Chaos

PART VI, DISTRIBUTED CIRCUITS: Transmission Lines, Multiconductor Transmission Lines, Time and Frequency Domain Responses, Distributed RC Networks, Synthesis of Distributed Circuits

PART VII, COMPUTER-AIDED DESIGN AND OPTIMIZATION: Modeling of Circuit Performances, Symbolic Analysis Methods, Numerical Analysis Methods, Design by Optimization, Statistical Design Optimization, Physical Design Automation, Design Automation Technology, Computer-Aided Analysis, Analog Circuits Simulation

PART VIII, ANALOG INTEGRATED CIRCUITS: Monolithic Device Models
Analog Circuit Cells, High Performance Analog Circuits, Broadband Bipolar Networks, RF Communication Circuits, PLL Circuits

PART IX, THE VLSI CIRCUITS: Digital Circuits, Digital Systems, Data Convertors

PART X, DESIGN AUTOMATION: Modeling Languages for AMS, RF & MW Modeling, Internet Based Micro-Electronic Design Automation Framework, System-Level Design, Synthesis at the Register Transfer Level and the Behavioural Level, Embedded Computing Systems and Hardware/Software Co-Design, Design Automation Technology Roadmap, Performance Modeling and Analysis in VHDL

PART XI, PASSIVE FILTERS: General Characteristics of Filters, Approximation, Frequency Transformations, Sensitivity and Selectivity, Passive Immittances and Positive-Real Functions, Passive Cascade Synthesis, Synthesis of LCM and RC One-Port Networks, Two-Port Synthesis by Ladder Development, Design of Resistively Terminated Networks, Design of Broadband Matching Networks

PART XII, ACTIVE FILTERS: Low-Gain Active Filters, Single-Amplifier Multiple-Feedback Filters, The Current Generalized Immittance Converter (CGIC) Biquads, Higher-Order Filters, Continuous-Time Integrated Filters, Switched Capacitor Filters

PART XIII, DIGITAL FILTERS: FIR Filters, IIR Filters, Finite Wordlength Effects, Aliasing-Free Reconstruction Filter Bank, VLSI Implementation of Digital Filters, Two-Dimensional FIR Filters, Two-Dimensional IIR Filters, Symmetry and 2-D Filter Design

This text contains most topics related to circuits and filters, from rather basic subjects, which are close to applied mathematics, to quite specialized topics

typically offered in graduate engineering courses. However, the topics related to systems theory are limited. Since the Second World War, in the area of systems we have witnessed a shift from transform methods of Laplace transform and z-transform towards state-space based methods that employ linear algebra. Comprehensive textbooks and reference material have been written on linear systems [10]. However, this material is not frequently used and is more oriented towards control theory. In many electrical engineering departments, the basic circuits and systems courses have been reduced. Nevertheless, they still play an important role in the engineering curricula. The basic circuits and systems courses are nowadays designed based on the courses in mathematics (linear algebra and differential equations) and physics (electricity and electromagnetism). They have links with signal processing and control theory. A basic CAS course contains Kirchhoff Voltage Law (KVL), Kirchhoff Current Law (KC), Thévenin theorem, Norton theorem, Tellegen theorem, concepts of energy and passivity, graph theory, circuit analysis, filter design, and concepts of impedances and hybrid parameters. Furthermore, they introduce concepts of continuous as well as discrete time systems impulse response, transfer function, stability, poles, zeros, time constants, Bode diagrams, and interconnections. Even though these topics are considered to be essential in electrical engineering education, they are often scattered or merged with other courses such as courses in digital signal processing or control. These relationships are outlined in Figure 1.

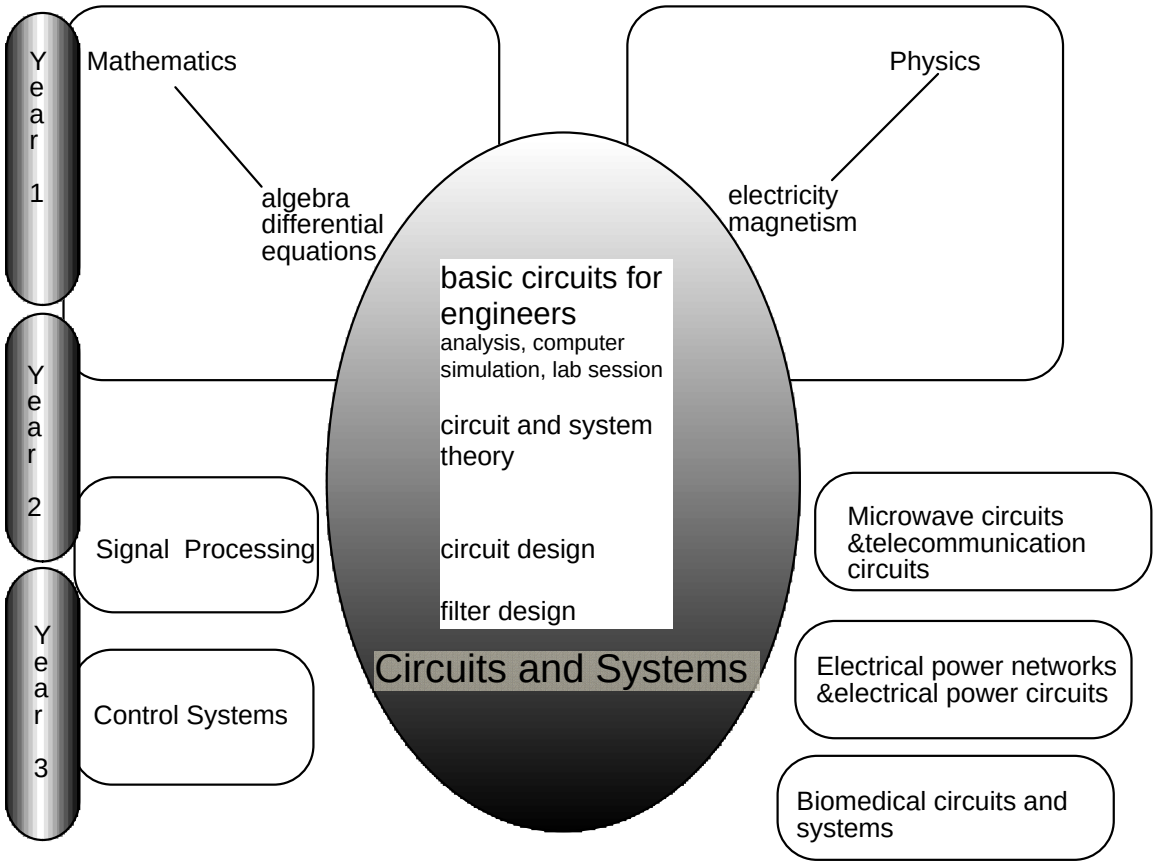

Figure 1. Links between circuits and systems courses with related courses in Electrical Engineering.

3. Current issues and developments in Circuits and Systems

Based on the previously discussed reflections and the experiences of the participants of the workshop, we can address the current issues and developments in CAS education.

We can state that the *topics covered in CAS education* are rather stable and common subjects in the education of electrical engineers. However there are several issues that affect their role. Engineers currently face increasingly complex systems and circuits and, hence, need additional insights and advanced tools for designing circuits. Furthermore, there is an increased role of computers and computer-aided tools such as SPICE and MATLAB and the use of the web and wikis. However, it is fair to say that methods of circuit analysis are not bypassed by simulations and that they complement each other. Basic concepts and insights do not become obsolete and are even more needed for analysis of complex systems. Moreover, there is increase in importance of nonlinear circuits and systems. While they were in the past considered to be curiosities that might be discussed in a final year graduate course, systematic employment of nonlinearities occurs nowadays in learning systems, sigma-delta modulators, cellular neural networks, and chaotic systems.

We note here several questions and open issues that are related to *the educational process of CAS topics*:

- How can the educational process capture the attention of the students and their motivation?
- Students in various parts of the world may be different from those of some years ago, and hence may need distinct ways of introducing the topics in the area of circuits and systems.
- Is the link between research and teaching in CAS still important?
- Is balance between theory, design, simulation, practice, and experimentation still required? Are hardware experiments still valuable or is software sufficient? What is the role of simulation tools such as SPICE and MATLAB?
- Should circuits and systems be taught jointly or in sequence? Should teaching discrete time systems be followed by continuous time systems or vice versa?
- Can one find good textbooks and reference materials or is there a need for new texts, updates, or other media (such as wikis).

We address some questions and open issues that deal [11] with *the relation between the society, the educational process, and the CAS topics.*

- The role of CAS education has drastically changed with the advent of computers and the Internet. New challenges such as environmental issues, energy shortages, and globalization offer new opportunities for CAS. Hence, when students learn about circuits as networks containing components and exhibiting dynamical behavior, they build a conceptual and a practical insight into systems. This can serve as an ideal basis for understanding various issues related to complex systems in other fields of technology, such as biology, world economy, climate, and environment systems. This link may be used to motivate students and to broaden their views.
- Can CAS topics be used for teaching students to understand the impact of engineering on society and the ethical issues related to the use of technology in society?
- There is a serious shortage of engineers. Hence, attracting students to engineering should begin early. Can the field of CAS provide examples that are fun for twelve-year old kids, stimulate their creativity, and motivate them to later begin engineering studies?

Moreover, several misconceptions circulate about CAS education:

- CAS topics are mature, basic, and generic for the field of electrical engineering and, hence, any faculty member in electrical engineering can teach them.
- There is no need to introduce circuits or mathematics of circuits and systems (linear algebra, differential equations, Laplace, Fourier, and z-transforms).
- There is no need to study CAS concepts such as KVL, KCL, modified nodal analysis (MNA), transfer functions, impedances, Bode diagrams andone should only learn to simulate circuits using SPICE and/or MATLAB.
- Industry is not interested in concepts and methods of CAS but, rather, in electronic products and services.

In order to address various questions and misconceptions, it was felt necessary to bring together different partners: instructors with diverse experiences, students or recent graduates (GOLD members), and industry. Hence, a one-day workshop was organized in Seattle at ISCAS 2008 with approximately twenty five participants with experience in CAS education (see Figure 2). Several participants currently in academia had previous industrial experiences. The teaching experience of the participants included topics on circuit theory, communication networks, signal processing, system theory, and communications.



Figure 2. Participants in the CAS Workshop, Seattle, May 2008.

4. Findings of the workshop

During the workshop, the problems, issues, valuable approaches, and recommended actions were extensively discussed. The details of the presentations and the discussions are available from the workshop webpage (http://www.esat.kuleuven.be/sista/CASeducationworkshop2008).

The findings and common understandings across the regions and the experiences were remarkably convergent and mutually stimulating. The participants reached consensus on the following main views and conclusions:

- *The skills and knowledge needed by industry.*
The industrial problems an engineer is expected to solve today in industry are of a different nature compared to the past. In the past, the tasks were better-defined and had a longer lifetime. Today an engineer should be a team player in a multi-sited environment. In the new industrial environment, an engineer is expected to have:

- good knowledge and understanding of the basics
- flexibility to work on various projects
- broad knowledge
- good communication skills
- to be able to apply his/her skills in practice.

-*The students:* [12]-[14]
The younger generation has not tinkered and young people are impatient. Since their experience is that everything takes place with pushing a button, they expect immediate gratification. They are familiar with software and the real world is somewhere else. Hence, at most places, one experiences a lack of interest by students in traditional circuits courses. This converges with the observations made by motivational psychologists in most countries that less than 20 % of the student population is strongly driven. Most of the students need to be motivated from “inside” with hands-on experience in parallel with the theory that is taught. Circuits and systems should be "fun". Hence, the first lab they will encounter must be a circuit’s lab rather than a software one. A hands-on approach lab will bring them in contact with the real world. The lab must be fun and motivational. Exciting their motivation is a significant step. The lab must make connections with applications and other courses.

- *The learning process from the point of view of the student*.
Learning is a process from the “tabula rasa” state of the student to the state of discovering the knowledge. There are different types of students who differently engage in this process. Furthermore, there are also different types of professors’ perception of the education process. The “René Magritte’s pipe syndrome” states: what is taught in classrooms is not the real system and the real world is sensed in the lab with a hands-on approach.
Several participants emphasized that a need for today’s education approach is a design-oriented analysis: a shift from “know-how” to “know-why”. Additional design-oriented courses need to be offered sooner in the engineering programs. Students should also develop skills for mathematical modeling and formulation of various systems concepts. This should be achieved in a pedagogical manner.

- *The topics of circuits and systems and their scheduling*
Most workshop participants were convinced that circuits and systems remain to be very important for education of electrical engineers and for their later careers. Most agree that we should teach continuous systems first followed by discrete systems and justified it by the fact that the world we conceive is continuous.

-*The teaching process itself can benefit from good experiences.*
Teaching itself should be attractive and should stimulate the thinking process. Several actions may be taken in order to stimulate students’ attention:

- carefully designing teaching “structure”
- developing geometric interpretations of the various concepts
- providing examples from applications
- including historical facts to help reflect the origin of the field and introduce open problems.

Interesting education-related information is available from the Richard Felder’s website: http://www4.ncsu.edu/unity/lockers/users/f/felder/public/

-*The importance of logistics*

Small universities and, in particular, those in developing countries need freely available educational material, including video-recorded lectures. It is also of importance to synchronize theory and laboratory exercises. Furthermore, there is need for modern tools and integrated learning platforms for teaching circuits.

Recommended actions:

- Establish the CAS Society Education and Outreach Technical Committee and issue an open call for active participation.
- Prepare a Special Issue of the CAS Magazine reporting experiences and adopted teaching models.
- A position paper to be generated by the CAS Society Education and Outreach Technical Committee.
- Develop a dedicated website to collect material related to the education issues.
- Establish collaborations with the IEEE Education Society.
- Advertise initiatives in CAS Magazine, CASS e-newsletter, and the IEEE Transactions on Education.
- Appoint CASS representatives to other IEEE Societies to observe and report on relevant discussions.
- Enrich the CAS Society Distinguished Lecturer Program with speakers on topics related to education.
- Work closely with regional CAS Society Vice Presidents and regional Chapters.
- Develop a series of video recordings of lectures and related educational material and enlist help from the CAS Society.
- Organize a discussion panel at ISCAS 2009.
- The CAS Society Education and Outreach Technical Committee should develop a list of objectives and tools with the goal to motivate students.
- Develop the CAS concepts inventory.
- Promote group-based design projects that promote active learning.
- Promote projects that “rattle things apart” and build systems for the first-year engineering students.
- Develop career trajectories in CAS.
- Promote ethics and professional conduct.
- Involve IEEE with the accreditation of academic programs.

In order to elaborate and consolidate these findings, conclusions, and actions, various presentations at the workshop were incorporated in the papers published in this special issue.

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References:

[1] F. Terman, “A brief history of electrical engineering education,” *Proceedings of the IEEE*, vol. 64, no. 9, Sept. 1976, pp. 1399–1406, reprinted in *Proceedings of the IEEE*, vol. 86, no. 8, Aug. 1998, pp. 1792–1800.

[2] W. L. Everitt, “Engineering education-circa 2012 A.D.,” *Proceedings of the IEEE*, vol. 87, no. 8, Aug. 1999, pp. 1397–1398.

[3] T. N. Trick, “Update on engineering education-circa 2012 A.D.,” *Proceedings of the IRE*, vol. 50, no. 5, May. 1962, pp. 571–572, reprinted in *Proceedings of the IEEE*, vol. 87, no. 8, Aug. 1999, pp. 1399–1403.

[4] R. Rohrer, “Taking circuits seriously,” *IEEE Circuits and Devices Magazine*, vol. 6, no. 4, pp. 27–31, July 1990.

[5] E. Guillemin, *Introductory Circuit Theory*. New York: Wiley, 1953.

[6] M. Van Valkenburg, “Teaching circuit theory: 1934–1984,” *IEEE Transactions on Circuits and Systems*, vol. 31, no. 1, Jan. 1984 pp.133–138.

[7] C. A. Desoer and E. S. Kuh, *Basic Circuit Theory*. New York, NY: McGraw-Hill, 1969.

[8] L. O. Chua, C. A. Desoer, and E. S. Kuh, *Linear and Nonlinear Circuits*. McGraw-Hill Series in Electrical Engineering: Circuits and Systems, New York: McGraw-Hill, 1987.

[9] W.-K. Chen (Ed.), *The Circuits and Filters Handbook*. CRC Press, 2nd edition, 2008.

[10] T. Kailath, *Linear Systems*. Upper Saddle River, NJ: Prentice Hall, 1979.

[11] J. Fouke (Ed.), T. Bell, and D. Dooling, *Engineering tomorrow, Today’s technology experts envision the next century*. *IEEE Press*, 2000.

[12] Y. Tsividis, “Some thoughts on introducing today's students to electrical engineering,” *IEEE CAS Newsletter*, vol. 9, no. 1, p. 1, 6–7, Mar. 1998.

[13] Y. Tsividis, “Teaching circuits and electronics to first-year students,” *Proc. IEEE Int. Symp. Circuits and Systems*, Monterey, CA, May/June 1998, pp. 424-427.

[14] Y. Tsividis, “Turning students on to circuits,” *IEEE Solid-State Circuits Newsletter*, Jan. 2008.



Joos Vandewalle was born in Kortrijk, Belgium, in August 1948. He obtained the electrical engineering degree and a doctorate in applied sciences, both from the Katholieke Universiteit Leuven, Belgium in 1971 and 1976 respectively. From 1976 to 1978 he was Research Associate and from July 1978 to July 1979, he was Visiting Assistant Professor both at the University of California, Berkeley. Since July 1979 he is back at the Department of Electrical Engineering (ESAT) of the Katholieke Universiteit Leuven, Belgium where he is Full Professor since 1986 and the head of the SCD division at ESAT, which has more than 130 researchers. From August 1996 till August 1999 and from August 2003 till February 2005 he was Chairman of the Department of Electrical Engineering. From August 1999 till July 2002 he was the vice-dean of the Faculty of Engineering at the Katholieke Universiteit Leuven. In the second semester of 2002-2003 he was on sabbatical leave at the I3S laboratory of CNRS Sophia Antipolis, France. From February 2005 on he is a member of the Governing Board of Science& Technology at the K.U.Leuven.

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He is the co-author of four papers that have received best paper awards: the IEEE Computational Intelligence Society Transactions on Neural Networks Outstanding paper Award, 2009, the Best student paper award of the IEEE Workshop on Multimedia and Signal Processing, 2007, the Best paper award of the Multimedia Metadata Applications (M3A) Workshop, 2007, and the Best student paper award of the European Signal Processing Conference (EUSIPCO), 2005.

He serves as an IEEE Signal Processing Society Distinguished Lecturer. He is a member of the Greek National Council for Research and Technology and Chairman of the SP advisory committee for the Edinburgh Research Partnership (ERP). He has served as vice chairman of the Greek Pedagogical Institute and he was for four years member of the Board of Directors of COSMOTE (the Greek mobile phone operating company). He is Fellow of IET and Fellow of IEEE.