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Keynote: Research and education in Telecommunication Engineering

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I. INTRODUCTION

Telecommunications over the past one hundred years has had a major influence on the development of society. Telecommunications will continue to play an increasingly important role in nearly every human endeavour in all nations of the earth.

Telecommunication industry is currently facing a technological revolution. In many countries, the number of cellular radio subscribers exceeds the subscribers of fixed telephony services. Internet technologies, such as VoIP and SIP, allow the convergence of traditional switched telephony services and data services of the internet to converge. New wireless access technologies compete and complete the services provided by the modern cellular radio networks. Ambient networks integrating heterogeneous networks and allowing dynamic selection of access revolutionise the business models of the teleoperators. Communication technology is becoming ubiquitous, sensors and actuators embedded in our environment will use wireless communication to adapt the environment to our current needs.

A mission of any electrical engineering department is to establish and nurture a national resource for education and research in the field of telecommunications. A primary goal is to provide continuing and advanced education in all aspects of telecommunications and associated technologies to students and experienced engineers presently employed in the industry. In addition to offering traditional courses in communications, information theory and coding, an electrical engineering department should offer courses in digital and cellular radio, advanced wireless propagation and communications, networks, data communications, satellite communications, fiber optic communications, and simulation of telecommunication systems. A wide range of research programs, both general and application-oriented, are to be conducted in all areas of telecommunications, and if support of local industry is there than the students are further motivated. Courses presented by any Electrical Engineering department staff should be by those who have had outstanding industrial research careers, as well by other staff who are nationally known leaders from the local industry.

II. ATTRIBUTES OF TELECOMMUNICATION ENGINEERING

A. What is telecommunications engineering?

In earlier times communications involved signal fires, flags, drums, messengers and even carrier pigeons. Today telecommunications engineers create devices and systems to allow much more effective and longer distant communication. Morse code telegraphy was probably the first real use of electricity for telecommunications, followed by radio. Now a single optical fibre, the thickness of a human hair, could carry half a million digital television channels.

Society depends heavily on the breakthroughs in telecommunications engineering. Applications include satellites, next generation mobile phones, air traffic control, the internet and much more.

B. What do telecommunications engineers do?

Typical tasks include:

1. management of engineering teams
2. designing telecommunications equipment including modems, switches, routers and radio links
3. developing real-time computer systems including imbedded computer systems and their software
4. building and testing prototypes of new equipment including integral circuit components
5. predicting telecommunication system performance
6. taking action to optimise the performance of telecommunications systems

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7. providing technical support to marketing or customer service staff and telecommunications technicians
8. providing training for technical and engineering staff once new systems have been installed
9. supervising special research projects on next generation telecommunication systems.

C. Employment opportunities

Studies by industry and governments both in Australia and internationally confirm strong and accelerating employment opportunities.

Employers include manufacturers of radio, television, and other audio/visual, broadcasting, and receiving equipment. Others include the developers of hardware and associated software, including computer systems, interfaces, security devices, data concentration, data transmission, signalling, satellite and radio communications and telephone equipment. Still others are service organizations that provide broadcasting, consulting, data communications, entertainment, custom manufacturing, research and development and telecommunication system support.

Multimedia services are opening up communications possibilities and therefore employment opportunities not dreamed of a few years ago. Examples include video conferencing, interactive video on demand, internet broadcasting of conferences and training programmes and the real-time transfer of huge amounts of information. Companies worldwide are competing to be the first to market with products such as digital mobile phones and network components that support the full range of internet services into compact integrated circuit chip sets. Specialised terminal equipment will become available for new and innovative applications, including telepresence and shared virtual reality worlds, with almost all existing communication network equipment being enhanced or replaced with exciting new technologies.

III. TELECOMMUNICATIONS ACTIVITIES AT VICTORIA UNIVERSITY

A. Centre for Telecommunications and Micro-Electronics

The Centre was established within the Faculty of Health, Engineering and Science at Victoria University, Melbourne, Australia in late 2001. The Centre aims to provide excellence in research and development in telecommunication and micro-electronic technologies, particularly through the strong partnerships it has established with Government, industry and research centres both nationally and internationally. The majored objective of the Centre is to create technologies that are required for future wireless telecommunication services and micro-electronic systems. The Centre pride itself in selecting research projects that benefit industry as well as being academically challenging.

B. Affiliations

1. Australian Telecommunications Research Centre
   www.telecommunications.crc.org.au
2. Chipskills Programme
   www.mmv.vic.gov.au/chipskills
3. Australian Microelectronics Network AMN - www.amn.org.au

C. Collaborative Links

1. Australian Telecommunications Cooperative Research Centre (ATCRC)

The ATCRC is a cooperative research centre supported by Commonwealth Government of Australia. It is a research partnership between industry, universities and governments. The ATCRC is focused on developing solutions that deliver "anywhere, anytime, anything" enhanced mobile service access with defined Quality of Service (QoS) across packet networks to support multimedia applications. The research carried out by ATCRC partners are in the following areas:

1. *Applications:* Multimedia over wireless networks, Ipv6 handover.
2. *Networking*: AAL type 2-traffic management and switching, routing algorithms for IP.
3. *Wireless:* W-CDMA scanner, Multi-element antenna systems,
   Media-Cell, coding and modulation and multi-user detection.
4. *Enabling Technologies:* Electromagnetic compatibility, signal in electronic and communication systems.

2. National Networked Tele Test Facility (NNTTF)

The NNTTF is a research facility established *through* funding through the Australian Government's Major National Research Facilities Program (MNRF). The NNTTF provides the state of the art research, education and training services using Agilent 93000 System-on-a-Chip (SoC) platform to satisfy the test demands for integrated circuit designs.

3. Chipskills Programme

Chipskills programme is a partnership of universities, industries and Victorian Government that provides postgraduate and professional development courses in microelectronic engineering. This is the only course in Australia developed and delivered in cooperation with industry, (like Ericsson, NEC, Fujitsu, Robert Bosch,

Agilent Technologies, Motorola, Semiconductor Technologies Australia), and is based on leading edge design tools such as Cadence and Synopsys.

4. Australian Microelectronic Network (AMN)

The AMN is a national industry development network with the objective of expanding the microelectronics industry in Australia. The vision of this network is to encourage a vibrant microelectronics design community with companies, governments and universities collaborating as part of a technology development cluster.

D. International Collaboration

The Centre is a member of the Heterogeneous Signal Processing Research project, collaboration with three Swedish Universities.

The Centre has informal links with a number of other Universities and Research Centres:

1. Bristol University (UK)
2. ACREO and Socware, Sweden
3. British Telecom Research Labs
4. University of California, Berkeley
5. National Microelectronics Research Centre, Ireland
6. York University, UK

E. Training Programmes Education

An important aspect of the Centre is to provide training in core activity areas. This is done through industrially focused and sponsored Chipskills programmes: Australian Telecommunications CRC, National Networked Tele Test Facility and Australian Microelectronics Network.

The School of Electrical Engineering at Victoria University also provides a number of postgraduate courses to complement Telecommunications and Microelectronics Strategic Research Areas.

These courses are:

1. M.Eng. Microelectronic Engineering
2. M.Eng.Sc. in Telecommunications Engineering
3. M.Eng. research degree in all the areas of the Centre activity
4. PhD research degree in all the areas of the Centre activity

F. Scholarships

Centre for Telecommunication and Micro-Electronics often receives funds from Industry and Government sources for applied research. Applications for most Government Scholarship close in October every year. Industry Scholarships are generally available throughout the year, depending on the availability of funds.

Research Students are working in the following areas:

1. Radio System Design. Capacity modelling and performance enhancement of cellular networks.
2. RF Systems circuits and Antennas. Terminal and Basestation Architectures.
3. Analog and Digital Electronics, Amplifier Design.
4. Signal Processing. Application of DSP to radio systems, eg. Adaptive antenna systems, Equalisation, Modulation etc.
5. Microelectronics, VLSI, System-on-Chip.

Applicants are required to have a good honours degree in Electronic or Communications Engineering (or equivalent in qualifications or experience eg Applied Maths), good analytical and communications skills, and enthusiasm for radio and signal processing. Australian Postgraduate Awards (APA), Internationally Postgraduate Research Scholarships (IPRS) and Vice Chancellor's Research Scholarships are due October every year. Scholarships are worth approx. $18,000.

A top-up bonus of $5,000 pa is offered to successful candidates undertaking approved research projects with the Centre for Telecommunications and Micro-Electronics. Scholarship duration is 3 years for PhD and 2 years for ME. Application forms can be obtained from Victoria University's Postgraduate Research Unit.