ENGINEERS INSIGHT

Automation Day 2015

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If you would like to be a part of the 'Engineers Insight' editorial team or have an article/paper published please contact: shankar@apu.edu.my

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Engineers Insight' is a quarterly issue by the School of Engineering for the reading pleasure of the staff and students allowing for knowledge sharing and capturing of events for the benefit of engineering education.

Every developed country has a Professional Engineering body that will oversee engineering practices conforming to International Standards. Most of them work as an authority organization to ensure there are means for engineering awareness among the youth with provisions made for members of the Professional Body to embark on their Continuous Professional Developments (CPDs). They also lay the platform and route to becoming a Professional Engineer via registration, experience gaining, fulfillment of CPDs and offering of exams.

Below are the top professional bodies as recognized under the Washington Accord;
EA - (Engineers Australia)
Engineers Canada - (Engineers Canada)
IEET - (Institute of Engineering Education Taiwan)
HKIE - (The Hong Kong Institution of Engineers)
EngIRE - (Engineers Ireland)
JABEE - (Japan Accreditation Board for Engineering Education)
ABEEK - (Accreditation Board for Engineering Education of Korea)
IPENZ - (Institution of Professional Engineers NZ)
IES - (Institution of Engineers Singapore)
ECSA - (Engineering Council of South Africa)
ECUK - (Engineering Council UK)
BEM - (Board of Engineers, Malaysia)
MUDEK - (Association for Evaluation and Accreditation of Engneering Programs)
AEER - Association for Engineering Education of Russia
**IESL** - Institution of Engineers Sri Lanka
NBA - National Board of Accreditation India

Professional Engineers (PEs) work to guarantee the public's safety and promote its interest where engineering matters are concerned. They must also ensure that provincial laws adequately and properly serve and protect the public, and participate in the establishment and maintenance of engineering standards while adhering to a code of ethics. PEs are experts in their field of engineering. In Malaysia for example, a PE carries the title 'Ir' at the beginning of his name, likewise in the UK a Chartered Engineer may have his 'CEng' written at the end of his/her name is an official manner.

In summary, Professional Engineer or Chartered Engineer status represents;
• The highest standards of professionalism
• Leadership
• Up-to-date expertise
• Quality and safety
• The ability to undertake independent practice.
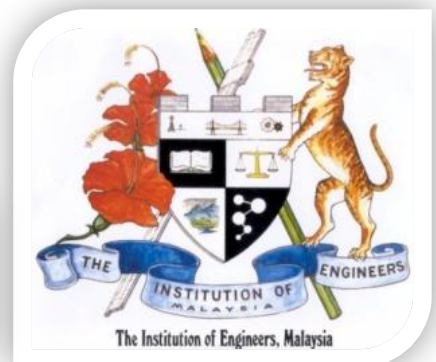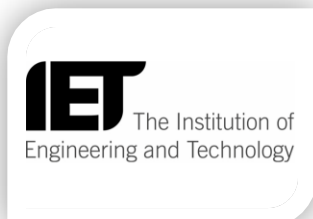
The Professional Engineering Academicians at APU

Prof Dr Ir Vinesh Thiruchelvam

To many, the PE license indicates that its holder has acquired a certain body of knowledge that says, "I am a competent engineer." That is true, but for the APU academicians the academic qualifications are also a measurements of technical competence. At APU currently we have the competent engineering group which is formed out of the PEs of APU;

1. Dr Thang Ka Fei, CEng (UK-MIET)
2. Ir Dr Dhakshyani Ratnadurai (BEM)
3. Alvin Yap Chee Wei, CEng (UK-IMechE), PE (USA-Arkansas)
4. Shankar Duraikannan, CEng (UK-MIET)
5. Arun Seeralan, CEng (UK-IMechE)
6. Veeraiyah Thangasamy, CEng (UK-MIET)
7. Ir Mathew Thomas, CEng (UK-IMechE), CPEng (Aus)
8. Prof Dr Ir Vinesh Thiruchelvam (BEM), CEng (UK-MIET,FIMechE)

The Competent 8, From Left; Dr Thang, Shankar, Ir Mathew, Prof Vinesh, Veeraiyah,
Ir Dr Dhakshyani, Arun

ASIA PACIFIC UNIVERSITY
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SCHOOL OF ENGINEERING

UNIVERSAL DESIGN -Product Design for Senior or Disable User

Ms. Vickneswari A/P Durairajah

Universal design is an approach to the design of all products and environments to be as usable as possible by as many people as possible regardless of age, ability, or situation. This concept does not have standards or requirements but addresses usability issues such as accessible product design for a senior person with a disability.

Universal Design takes into account the full range of human diversities, including physical, perceptual and cognitive abilities, as well as different body sizes and shapes. By designing for these diversities, we can create things that are more functional and more user-friendly for anyone. For instance, curb cuts at sidewalks were initially designed for people who use wheelchairs, but they are now also used by pedestrians with strollers or rolling luggage as shown in Figure 1. Curb cuts have added functionality to sidewalks that we can all benefit from.
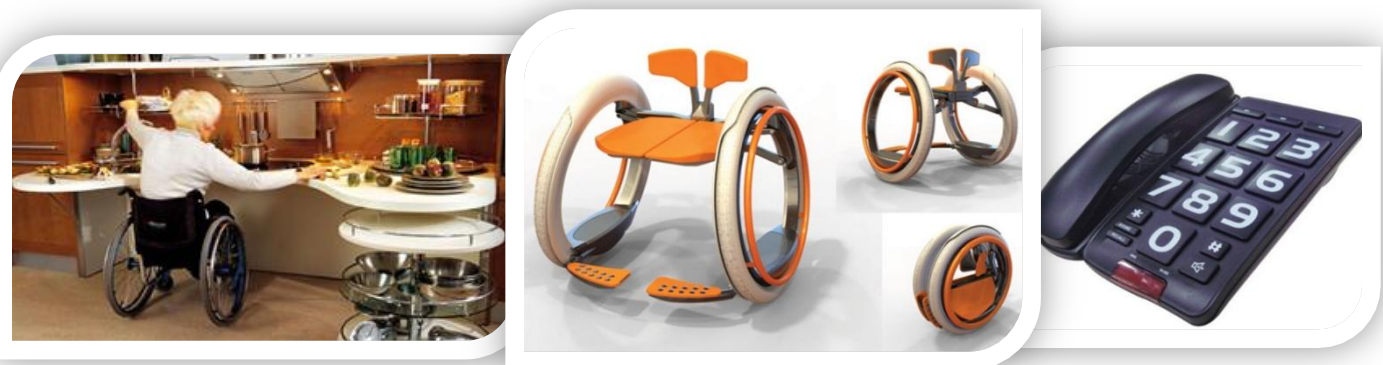

Figure 1

Barrier free design and assistive technology provide a level of accessibility for people with disabilities but they also often result in separate and stigmatizing solutions, for example, a ramp that leads to a different entry to a building than a main stairway or automatic ramps that are used to board public transportation such as buses or train as shown in Figure 2 would assist a wheel chair user or some senior citizen.

Figure 2

Figure 3 shows example of products or areas redesigned to suit senior citizens and wheel chair users such as the kitchen layout and the way the items are place that will make the wheel chair user to easily navigate around the kitchen and engage in cooking followed by wheel chair designs which are self-stabilizing and easy to store. There is also the telephone extra-large number keys and louder ringers for senior citizens. Nowadays we could also use a smart phone with a voice command to call which could assist senior citizens and visual impaired people.

Figure 3

Figure 4 shows example of products which have been designed or redesigned to suit hearing impaired users such as the telephone that converts speech into text for easier understanding, a vibrating band that will alert hearing impaired users on phone calls, a doorbell or electrical appliances in completing a task and last but not least the electrical kettle that laminates with a different colour to indicate the difference between non boiled water (light blue), while boiling (bright blue) and completed boiled water (red).


Figure 4

Figure 5 shows examples of a phone that alerts the user and calls are controlled via voice command, an analogue watch which can be sensed with a touch or a watch with has voice command on a press of a button, a hand phone that use a braille key pad and a rubric cube that uses braille. Universal design strives to be a broad-spectrum solution that helps everyone, not just people with disabilities.

Universal design is assuming growing importance as a new paradigm that represents a holistic and integrated approach to design ranging in scale, for example, from product design to architecture and urban design, and from simple systems such as those that control the ambient environment to complex information technologies. Universal design is an approach to the design of any products to be usable by everyone, to the greatest extent possible, regardless of age, ability, or situation. It serves people who are young or old, with excellent or limited abilities, in ideal or difficult circumstances. Universal design benefits everyone by accommodating limitations. As the world's population ages, so does the demand for senior appropriate homes, renovations, and assistive devices. Universal design can help designers, builders and remodelers address the needs of their older clients, and designer to redesign product for every need.

*Idea adapted from http://www.disabled-world.com/assistivedevices/design/
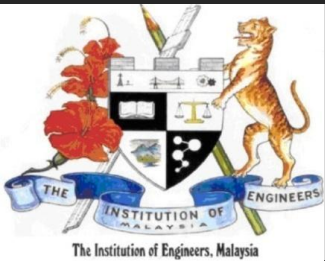
Figure 5

The Institution of Engineers, Malaysia

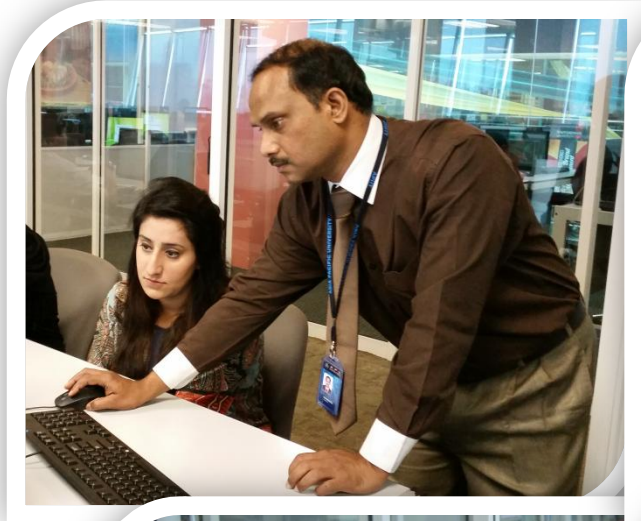## DEALING WITH NONLINEARITIES IN DYNAMIC SYSTEM MODELLING, IDENTIFICATION & CONTROL

An invited talk on 'Dealing with Nonlinearities in Dynamic System Modelling, Identification & Control' by Prof. Quan Min Zhu, Department of Engineering Design and Mathematics, University of the West of England, Frenchay Campus, UK , was held on July 03, 2015. The talk was focused to mathematical modeling of nonlinear systems. 60 students 15 staff attended the talk.

The Institution of Engineers, Malaysia
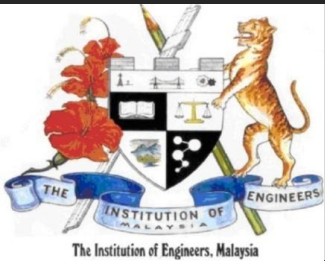
JAVA PROGRAMMING

Two sessions of 'Workshop on Java Programming' was conducted by Mr. Kadhar Batcha Nowshath on July 24 & 31, 2015. The workshop was focused to basic Java programming and Object Oriented GUI programming. 30 students attended the workshop. It was a great initiative by the School of Computing to improve engineering students in their progress of programming skills.
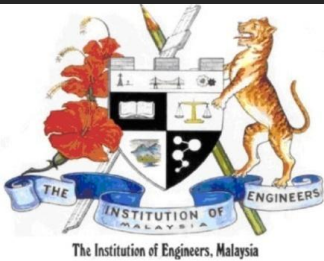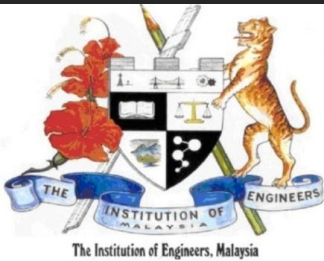
SEMINARS & WORKSHOPS

ENGINEER – QUESTION OF CHOICE

An invited talk on 'Engineer – Question of Choice' by Prof. Dr. Ir. Hj. Kamsani, Industrial Advisory Panel Member of SoE, was held on August 06, 2015. The talk was focused to significance of professional engineering status in an engineering career. 60 students and 5 staff attended the talk.
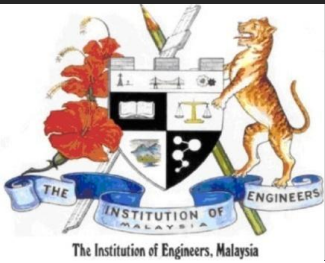
SEMINARS & WORKSHOPS

OPERATION OF ELECTRICAL MACHINES

On August 14, 2015, a 'One Day Workshop on Operations of Electrical Machines', was conducted for engineering students to improve their knowledge in motors/machines. The workshop broadly covered the power lab and safety issues, operation of the universal power supply, running of electrical machines and measurement of voltage, current and speed. 6 students and 2 staff attended the workshop.
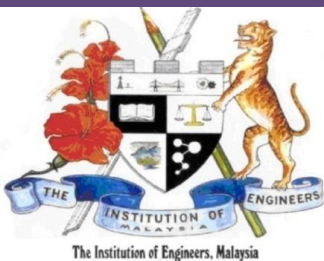
SEMINARS & WORKSHOPS
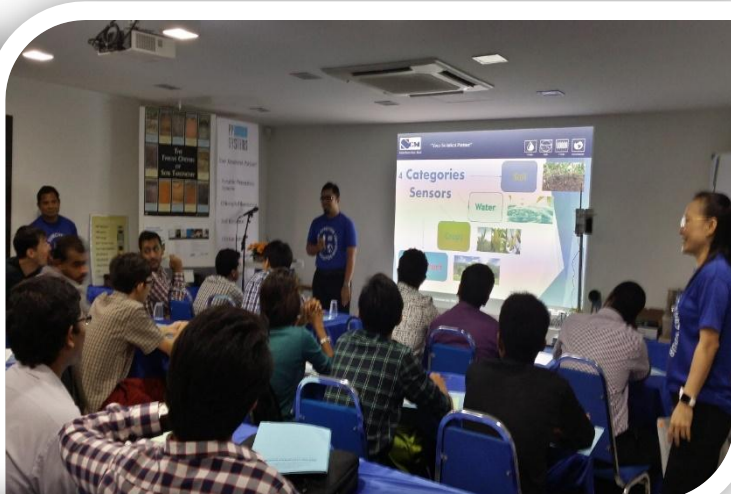
VAGLER 3D - PRINTERS

VAGLER Technologies is a global manufacturer of high quality and innovative 3D printing products. On August 14, 2015 a Technical Talk and Demo on 3D Printers were conducted by VAGLER. 60 students and 10 staff attended the session.
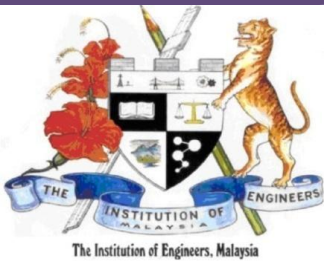
INDUSTRIAL VISITS

SURECHEM SDN BHD

SURECHEM Sdn Bhd is an organization that specializes in the field of Soil, Water, Crops, Climate, Environmental, Waste and Physical Survey via supply and distribution of instruments. On July 2, 2015 the 21 students accompanied by 3 staff who visited Surechem Sdn Bhd had an opportunity to witness the sensor technologies and the market demands.
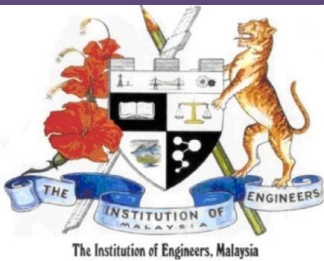
INDUSTRIAL VISITS

The Institution of Engineers, Malaysia

HIGH VOLTAGE ENGINEERING LAB, UNIVERSITY MALAYA
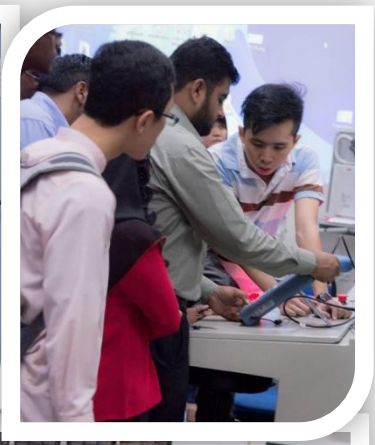
On July 29th 2015, 20 students accompanied by 4 saff, visited the state of the art UMHVL that serves as a teaching and research lab in the Department of Electrical Engineering at University Malaya. The students witnessed demonstrations on equipment commonly used in high voltage engineering such as high voltage kits, partial discharge testing and measuring equipments, leakage current measuring systems, cable fault location equipments, thermal imagers and analysis workstations.
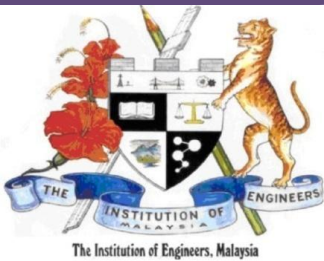
INDUSTRIAL VISITS

The Institution of Engineers, Malaysia

AM SGB SDN BHD

AM SGB Sdn Bhd, located in Nilai, is one of the world's leading manufacturers of distribution, power and cast resin transformers with more than 60 years of experience in the manufacturing high-quality transformers. The manufacturing range of AM SGB consist of: Oil distribution transformers up to 5,000 kVA, Cast resin transformers up to 3,500 kVA, Power transformers up to 40 MVA. On August 19, 2015, 19 students accompanied by 2 staff visited the manufacturing facility.

The Institution of Engineers, Malaysia

TM RESEARCH & DEVELOPMENT

TM Research and Development plays a pivotal role in translating research into development in the fields of connectivity, digital services, E3 infra and productive tools. On August 25th 2015, 20 students in telecommunication engineering accompanied by 2 staff members visited TM R&D and had an opportunity to see in depth research and development in the field of telecommunication engineering.

SOE COMPETITIONS

International Energy Innovation Competition (EiC)

APU students from the **School of Engineering** excelled in the **International Energy Innovation Competition (EiC)**, which was organised by the **Institute of Engineers Singapore (IES)**. They were placed the **First Runner Up and 4ᵗʰ Place.**

Held in **Suntec Exhibition Centre** in parallel with the **2015 World Engineers Summit**, the **Energy Innovation Challenge** attracted participation of teams from **Singapore, China, Australia, Philippines, Indonesia, Thailand and Malaysia**. Despite having stiff competition from their fellow competitors, the APU teams impressed the judges with their innovative ideas and outstanding presentation. **APU's 1st team**, which comprised **Cleopatra Musa and Syed Abdullah**, integrated fitness with eco-friendly technology to produce the **"Eco-Friendly Weight Lifting Machine"**. Their innovative prototype outstood other teams; as they bagged the **First Runner Up position** and walked away with a cash prize of **S$ 5,000 and a trophy**!

Jasmine Kaur, who fought alone with strong determination as the **2nd team**, walked away as the **4ᵗʰ Place winner**, with her innovative solution – **"Eco-Friendly Ceiling Fan as an Alternative Approach to Air-Conditioners"**. Both teams were mentored by **Prof Vinesh.** It was a great platform for the students to showcase their talents at the international level; moreover, they had the honourable opportunity to receive the prizes from **Singaporean Minister for Education, Mr Heng Swee Keat**!

SOE FINAL YEAR PROJECTS

**Final Year Project
Presentation
UC4F1411**

Multiband Low Noise Amplifier for LTE Applications

Veeraiyah Thangasamy, Noor Ain Kamsani

Research Motivation:

With increasing demand for high data rate services such as: social networking, web browsing, video streaming, music downloads, gaming, and many other popular applications, wireless communication devices are facing the challenge of supporting multiple air interface technologies such as HSPA, HSPA+, WCDMA and LTE (multimode). Also, with growing number of frequency bands used in different geographies around the world and to facilitate international roaming these devices are required to operate on number of frequency bands (multiband). This paper presents a design of multiband LNA in 130nm CMOS process technology. The designed LNA can operate on five major LTE bands used in the smartphones. And it will fulfill the multiband LNA needs in the RF front-end of the 4G and NGN wireless devices.

Multiband LNA Design Methodology

A common source topology with source degeneration is used in this design as shown in the complete schematic of the proposed LNA of Fig. 1. It used common source transistor (M1) in cascode with common gate transistor (M2). The common gate transistor provides good reverse isolation while the common source transistor provides necessary gain for the amplifier. The proposed circuit uses a transistor (M3) based shunt feedback that provides lower noise figure than the resistor feedback. The feedback transistor also provides necessary bias voltage for the input transistor M1. Parallel LC tuned circuit is used at the output to match the LNA output to 50Ω load impedance. Inductor Ld in parallel with capacitors C3 and C31 resonate to impedance match the LNA output to the load. A π matching network at the input is used match the LNA input impedance to the 50Ω source resistance. Transistor M4 and M5 are connected as varactors that are in series with capacitors C1 and C2 respectively; and the transistors M7 and M8 are connected as switches that connects the capacitors $C1^1$ and $C2^1$ to the π matching network.
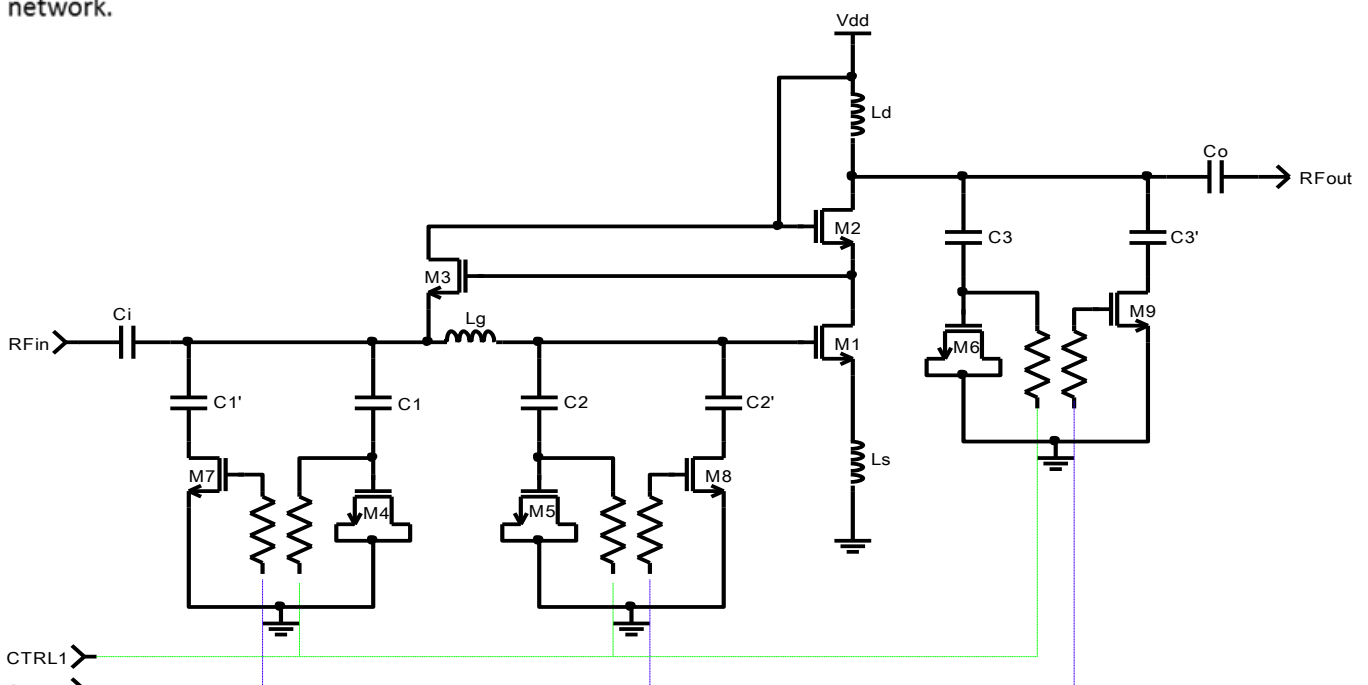

Fig. 1: Multiband LNA schematic

Results Discussion and Conclusion

The designed multiband LNA is simulated using the Cadence® Spectre® tool in the 130nm CMOS process; and the simulated frequency response for the LTE high-band and low-band frequencies are shown in Fig. 2 and Fig. 3 respectively.
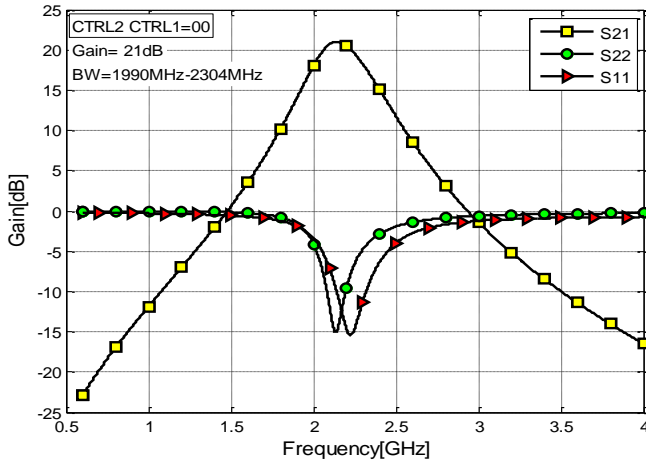

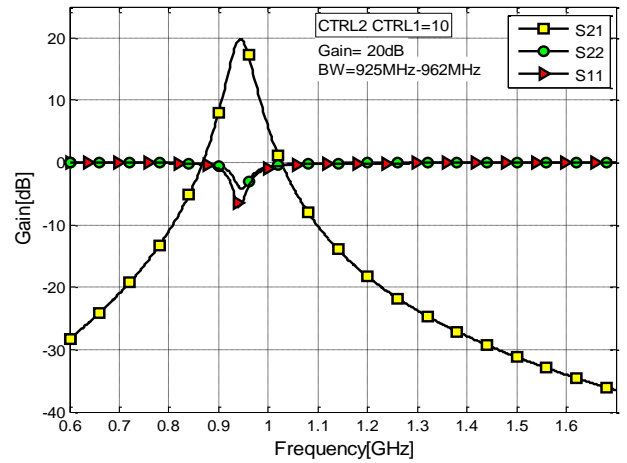Fig. 2: Gain versus frequency for LTE high-bands

Fig. 3: Gain versus frequency for LTE low-bands

The designed LNA provides a gain of 21dB and 20dB in the high-band and low-band frequencies. The noise figure response of the designed LNA is shown in Fig. 4 and it provides a noise figure value of 2.8-4.35 across the LTE frequencies. A figure of merit (FoM) is used to compare different circuits with same functionality. As such, the FoM suitable for evaluating the performance of proposed LNA can be defined as [4]

$$FOM = \frac{S21.BW}{(F-1).Pd}$$

where *S21* is the gain in magnitude, *BW* represents bandwidth in GHz, *F* represents noise figure in magnitude and *Pd* represents power dissipation in mW. Higher the FoM better the performance of the LNA. Table 1 summaries the important parameter of the proposed LNA along with reported state-of-the-art 130nm CMOS LNAs in the literature. The proposed LNA exhibits higher gain, lower noise figure and a higher value of FoM; making it a suitable design for the multiband operation in emerging LTE and NGN communication front-ends.
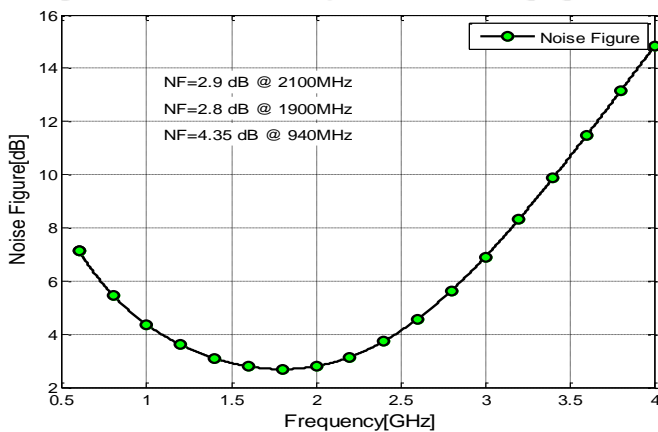

Fig. 4: Noise Figure vs frequency across LTE bands

Table 1: Comparison of proposed LNA with the state-of-the-art CMOS LNAs

Parameter	This design	[2]	[3]
Process	130nm CMOS	130nm CMOS	130nm CMOS
Supply (V)	1.2	1.5	1.4
Frequency (GHz)	0.92 -2.3	0.5-1.0	2-9
Gain (dB)	20-22.3	11-12	10.5-12.5
Noise Figure (dB)	2.8-4.35	3-5	4.45-9
IIP3 (dBm)	-15	0.72	-
P_d (mW)	20.7	46.4	28
FOM	7.34	0.099	1.08

References

[1] N. Q. Bolton, "Mobile Device RF Front-End TAM Analysis and Forecast," in CS MANTECH Conference, 2011, pp. 39–42.

[2] H. L. A. Pimentel and S. Bampi, "A 50MHz-1GHz Wideband Low Noise Amplifier in 130nm CMOS Technology," in 25th Symposium on Integrated Circuits and Systems Design (SBCCI), 2012, pp. 4–9.

[3] T. Taris, J. B. Begueret, and Y. Deval, "A low voltage current reuse LNA in a 130nm CMOS technology for UWB applications," in 37th European Microwave Conference, EUMC, 2007, pp. 307–310.

[4] I. C. Chen and J. R. Yang, "3-10GHz CMOS distributed amplifier low-power and low-noise and high-gain low noise amplifier for UWB systems," IEEE Reg. 10 Annu. Int. Conf. Proceedings/TENCON, pp. 2045–2047, 2010.

RAPID PROTOTYPING

Ir. Dr. Dhakshyani A/P Ratnadurai

Rapid Prototyping (RP) can be defined as a group of techniques used to quickly fabricate a scale model of a part or assembly using three-dimensional computer aided design (CAD) data. The first RP technique, Stereolithography, was developed by 3D Systems of Valencia, CA, USA. The company was founded in 1986, and since then, a number of different RP techniques have become available.


http://www.rolanddga.com
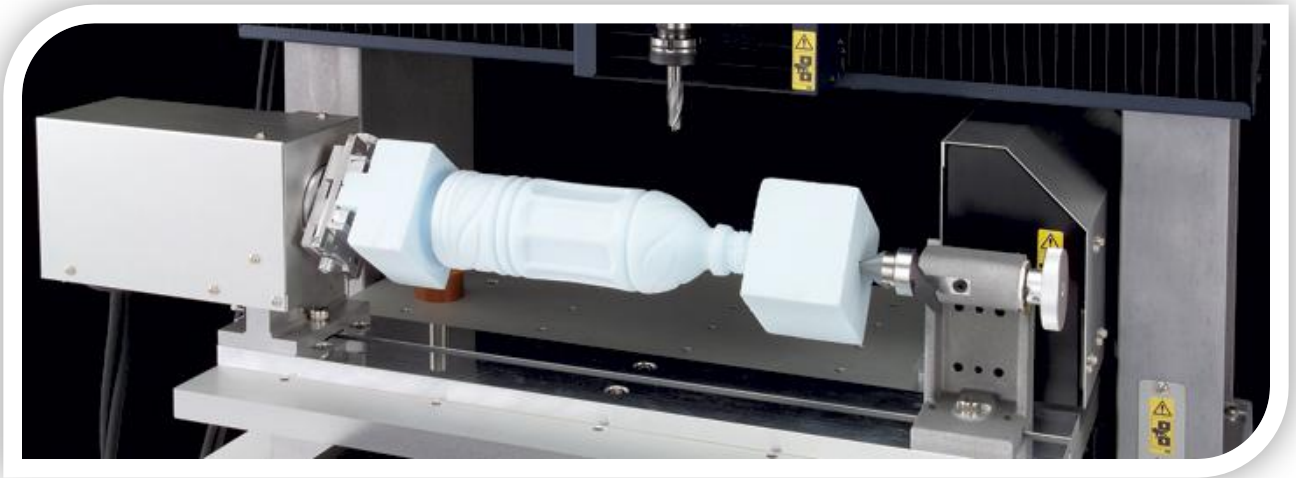
RP has also been referred to as solid free-form manufacturing, computer automated manufacturing and layered manufacturing. RP has obvious use as a vehicle for visualization. In addition, RP models can be used for testing, such as when an airfoil shape is put into a wind tunnel. RP models can be used to create male models for tooling, such as silicone rubber molds and investment casts. In some cases, the RP part can be the final part, but typically the RP material is not strong or accurate enough. When the RP material is suitable, highly convoluted shapes (including parts nested within parts) can be produced because of the nature of RP.

There is a multitude of experimental RP methodologies either in development or used by small groups of individuals. This section will focus on RP techniques that are currently commercially available, including Stereolithography (SLA), Selective Laser Sintering (SLS®), Laminated Object Manufacturing (LOM™), Fused Deposition Modeling (FDM), Solid Ground Curing (SGC) and Ink Jet printing techniques.

Why Rapid Prototyping?

- To increase effective communication.
- To decrease development time.
- To decrease costly mistakes.
- To minimize sustaining engineering changes.
- To extend product lifetime by adding and eliminating redundant features early in the design.

RP decreases development time by allowing corrections to a product to be made early in the process. By giving engineering, manufacturing, marketing, and purchasing a look at the product early in the design process, mistakes can be corrected and changes can be made while still being inexpensive. (http://www.efunda.com)

http://manufacturing.eng
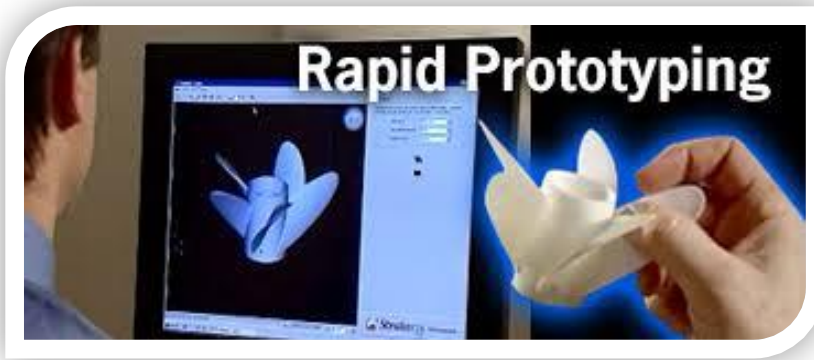
The trends in manufacturing industries continue to emphasize the following:

- Increasing number of variants of products.
- Increasing product complexity.
- Decreasing product lifetime before obsolescence.
- Decreasing delivery time.

RP improves product development by enabling better communication in a concurrent engineering environment.

Methodology of Rapid Prototyping

The basic methodology for all current rapid prototyping techniques is as follows:
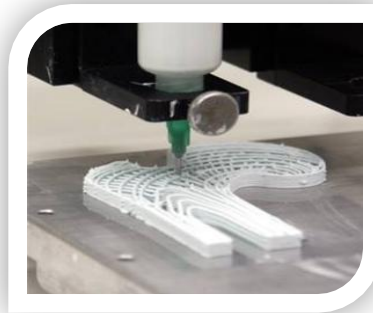
www.ipds.com

1. A CAD model is constructed, then converted to STL format. The resolution can be set to minimize stair stepping.
2. The RP machine processes the .STL file by creating sliced layers of the model.
3. The first layer of the physical model is created. The model is then lowered by the thickness of the next layer.
4. The process is repeated until completion of the model.
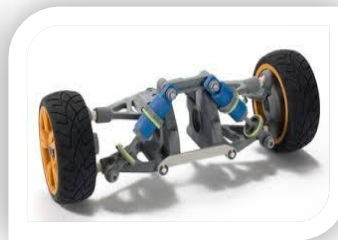5. Then the model and any supports are removed. The surface of the model is finished and cleaned.

Prototype examples:

www.solidconcepts.com   www.makexyz.com   www.multipino.com   www.rpprototype.com

RP technologies are frequently used towards the beginning of the product development lifecycle to create prototypes or parts used to test and verify designs before full production begins. RP services are used in nearly every industry and can be used to prototype everything from a movie prop to a space shuttle component.

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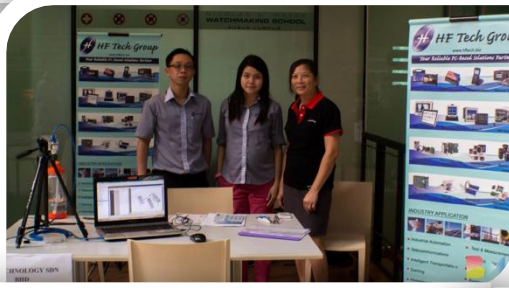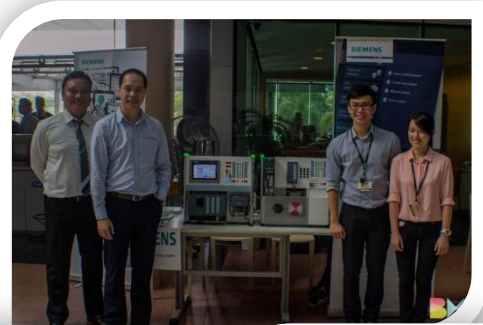
The School of Engineering, in conjunction with Malaysia Automation Technology Association (MATA), organized the Automation Technology Day on September 29, 2015. The event is part of the initiatives by MATA to reach out to APU's Computing and Engineering students in terms of jobs, internships and awareness of automation technology in general. A total of 15 companies and MATA exhibited Graduate Jobs and Internship Opportunities for Computing and Engineering students. Career and Technical talks by experts were;
MATA and Automation Industry by Mr. Tiong Khe Hock, President MATA
Industry 4.0 by Mr. Goh Siew Boon, Siemens Malaysia Sdn. Bhd
Smart Building, Ms Therese Leong, Schneider Electric (M) Sdn. Bhd
Process Automation using Simulation, Mr. Martin Mueller, IME Technology Sdn. Bhd
How to Land a Good Job in Technology Sector, Mr. Low Fang Kai, VHR
Finally a workshop on Industrial Automation was conducted by Mr KM Chua, Bistanika Sdn. Bhd