IEEE Hyderabad Section

SYNAPSE

The Newsletter of IEEE Hyderabad Section

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Editor in Chief: Prof. Lakshminarayana Karre Editor: Dr. Mohammed Arifuddin Sohel

Message from Dr. Koduri Srinivas, Chair, IEEE Hyderabad Section

Dear Esteemed Members,
At the outset, let me extend my "Seasons Greetings and Best Wishes for a Bright Healthy Happy Prosperous New Year". The good efforts of our Editor-in-Chief Dr. Lakshminarayana Karre and Editor Dr. Mohammed Arifuddin Sohel have resulted in releasing this issue of our section newsletter "Synapse" as two volumes. The second volume is a special issue of international conferences conducted by the section or have been technically co-sponsored by the section with IEEE or its societies.

Special thanks are due to general co-chairs of all seven conferences for choosing Hyderabad as the venue. We have had a galaxy of eminent scholars, fellows of IEEE to deliver the many tutorials and keynote address on futuristic trend setting topics. Given the high quality of papers that have been accepted and presented, the need of the hour is to have more opportunities for research scholars and practicing professionals to exchange their ideas. I thank all committees, faculty members, staff and managements of the many academic institutions and the wonderful student volunteers who have worked very hard to make these conferences such a grand success.

R10 Director Sri Ramakrishna Kappaganthu, has been very kind to spare his valuable time to address the section executive committee twice at Hyderabad and at both the Zonal Student Congresses at Vishakapatnam and Anantapur. In addition to extending a lot of financial support for our section activities, he and Dr. MGPL Narayana have harnessed the talent of our section volunteers for many Region 10 activities including "AIYEHUM 2015" Humanitarian Technology Project Contest.

Dr. KMM Rao and Dr. Lakshminarayana Merugu have conducted "All India Seminar on ICT in Space, Defence and Industrial Applications" with Prof. BL Deekshatulu delivering an excellent keynote address as Chief Guest. The event was a grand success for the second successive year. I hope IEEE, Institution of Engineers(IE) and Institution of Electronics and Telecommunication Engineers(IETE) join hands to provide a common forum for all professionals to exchange their ideas.

The section and its chapters could conduct many distinguished lectures, tutorials lecture and workshops not only in Hyderabad but in other parts of Telangana and Andhra Pradesh. I am pleased to note that these efforts have been recognized by IEEE and Region 10. Our Vice-Chair Dr. Lakshminaraya Merugu has bagged the Region 10 Outstanding Volunteer Award for year 2015 and under the chairmanship of Prof. Balasubramanian RamaswamyP ES chapter has bagged the 2014 IEEE PES Chapters High Performing Chapters Program award. In addition, IEEE MTT society has noted the excellent work undertaken by our MTT chapter and am sure Dr. Nookala Srinivasa Rao and his team are likely to get the best chapter chair award for year 2015. I would like to compliment them for their excellent work and becoming inspirational role models for all of us. At the same time, kindly permit me to acknowledge the very commendable work all other chapter chairs and their teams have put in. It is only a question of time that their wonderful work gets its due recognition.

I would like to acknowledge with thanks the efforts of silver jubilee FML committee (Prof. Doradla - Chair, Sri. C. Satish and Dr. KMM Rao) Dr. Madhumita Chakravarthy and Prof Venkatesh and their team of volunteers making our annual flagship events for JC Bose and Graham Bell Memorial lectures very noteworthy and memorable. I would also like to thank Prof. Vijayalatha our SAC Chair and her four very dynamic zonal student activities coordinators at Vishakhapatnam, Warangal, Hyderabad and Ananthapur zones in their efforts to reach out to 118 student branches across Telangana and Andhra Pradesh states. Thanks to the efforts many seniors of SEC including Sri Gopalakrishna Kuppa we roped in world class speakers for section student congresses at Hyderabad, Vizag and Ananthapur. Likewise, women participation in section and WIE events has gone up significantly thanks to the efforts of Dr. Arni Swarna Bai WIE Chair and her team of volunteers. Sri Ram Manohar Sharma YP Affinity Group Chair has also made noteworthy contributions for their and other section events. With focused efforts we will be in position to harness YP potential shortly.

I also congratulate our Vishakhapatnam Subsection Chairmanship of Dr. S. Lakshminarayana, student zonal coordinators and other volunteers in their endeavor to promote the IEEE activities outside Hyderabad and am confident that at this rate they will be shortly elevated to a section.

Nomination Committee identified an excellent team as SEC slate for the current year. I am very confident that the new team will perform exceptionally well under able leadership of Dr. Lakshminaryana Merugu.

I also thank all my mentors, fellows of IEEE, many seniors and all past SEC chairs, and their teams for all their love and for granting this wonderful opportunity to serve you.

With warm regards and best wishes
Srinivas Koduri

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Faraday Memorial Lecture (FML -2015)

IEEE Hyderabad section conducted the Faraday Memorial lecture on 22nd September 2015 at PS Telugu University Auditorium, Nampally. Prof. Narendra Ahuja, Director, I .T. R.A, Media Lab Asia, Department of Information Technology, Govt. of India, New Delhi and Research Professor, Electrical and Computer Engineering, University of Illinois at Urbana-Champaign, delivered the talk on "Information Technology Research Academy: An effort under way to strengthen National R and D culture". Details are available at: http://medialabasia.in/itra/itra/index.php.

Dr. Koduri Srinivas, Chairman Hyderabad Section has delivered the welcome address. Shri. C. Satish, senior member, IEEE Hyderabad section gave over view of silver jubilee FML 2015 and in general on the FMLs conducted so far. Dr.K.M.M.Rao has introduced the speaker. Dr. M. Laxminarayana, Vice Chair IEEE Hyderabad section presented the vote of thanks. Around 250 participants attended the talk, which was very well received.

Dr. M. G. P. L. Narayana, past chairman, IEEE Hyd section presenting a memento to the speaker, Dr. Narendra Ahuja.

Prof. Narendra Ahuja with IEEE Hyderabad Section members

Section Student Congress –SSC 2015

The IEEE Hyderabad Section organised its annual Section Student Congress –SSC 2015 from 3-4 October 2015 at DST auditorium, HCU. The theme of the congress was "Engineering for a better tomorrow"- You Come. You Learn. You Implement. It was organised by The IEEE Hyderabad Student Network which is a conjunctive body that aims to connect different Student Branches under the Hyderabad Section and operates in close association with the Students Activity Chair (SAC) and Section Committee.

The Section Student Congress was aimed at providing a platform for all student members of various student branches of IEEE Hyderabad Section wherein they could learn, teach, network and co-ordinate activities. The Congress witnessed its highest ever attendance in this edition with over 450 participants from 42 different student branches from all 4 zones of IEEE Hyderabad Section, the four zones being Hyderabad, Visakhapatnam, Warangal and Ananthapur. The Congress was an amalgamation of Technical Talks, Office Bearers Meetings, Talks on Entrepreneurship and also interactive ice breaking sessions.

In the inaugural session, Dr.Y.Vijayalata - SAC Chair of IEEE Hyderabad Section presented the welcome address, Dr. K. Lal Kishore - Vice Chancellor JNTU Anantapur and chief guest addressed the gathering, Dr. Koduri Srinivas - Chairman of IEEE Hyderabad Section, summarized the event Mr. Lakshminarayana - Vice Chair of IEEE Hyderabad Section, and Mr.Bharath - Student Network representative of IEE E Hyderabad Section proposed the vote of thanks.

The day started with a technical lecture by Dr. Kota Harinarayana - Distinguished Professor, IIT Bombay. He spoke on "National Security, Aviation Technology & LCA". This was followed by a panel discussion on "Volunteering Capsule" by Dr. Kannan Rajagopalan, Dr. A. Swarna Bai, Mr. Vinit Kumar Gunjan and Mr. Tushar Karumudi. The afternoon session had a Technology Capsule with title "Engineering for a Better Tomorrow" by Dr. Atul Negi, Dr. M. Lakshminarayana, Mr.K.Gopala Krishna, Mr. N. Venkatesh, and Dr. Amit Kumar. This was followed by a talk by Mr. Venkata Ramana Vemuri on "Human Resource Needs for Make in India". Alongside the last session, the Student branches contesting for the Emerging and Vibrant SB Awards set up their stalls with three of their Executive committee members and gave a presentation regarding all the events that were done in their respective Student Branch from September 2014 to September 2015.

Panelist of Volunteering capsule

The first session on the second day was a Panel Discussion on "Entrepreneurship as a Career" by Mr. Ramesh Loganathan (leader of the Progress Software's largest product development laboratory), Mr. Aditya Vuchi (Entrepreneur; Founder of Zippr and Founder/CEO of Media Mint), Mr. Sainath Guptha (Entrepreneur; Founder and CEO of Aasaanpay) and Dr. Amit Kumar (CEO and chief scientific officer at Bio access DNA Research Centre).

The second session was by Dr. Syed Maqbool Ahmed, Principal Scientific Officer, University of Hyderabad. His session was on "Frontiers in Space Sciences". The third session for the day was by Mrs. Sharda Avdhanam, Director (Retd.), APFSL, Hyderabad. Her session was on "Forensic Sciences". This session educated the students about APFSL (AP Forensic Science Labs). Dr. Venkateswaran Narayan, Head, Research Department, ABB India Corporate Research Centre, Bangalore gave a technical talk on "Home Automation Solutions". The session highlighted the various IOT technologies required for automation.

In the valedictory session , Emerging Student branch Award and Vibrant Student Branch Award were declared. The Section Student Congress (SSC'15) came to an end with a report presentation by Dr.Y.Vijayalata, SAC Chair, IEEE Hyderabad Section.

Dr. C.G. Balaji, Director DLRL, presenting a certificate at the Valedictory session of SSC 2015

2015 IEEE region 10 SAC – SAC chairs, Counselors and Mentors Meet

IEEE Hyderabad Section has taken its first step yet again in the year to host the 2015 IEEE Region 10 SAC – SAC Chairs, Counselors & Mentors Meet in along with Section Student Congress that happened on 4th October 2015. The event has been held at Sir. C. V. Raman Auditorium, Hyderabad Central University campus. The ultimate goal is to motivate and engage the SAC Chairs, Counselors & Mentors of the Student Branches to come together to work collaborated and also to inculcate the spirit of volunteering among them. In the inaugural session Dr. Kannan Rajagopalan talked about his journey in IEEE and passion towards working with like-minded people of the society. Dr. N.V Rao enlightened the delegates about the importance of volunteering in IEEE. Mr. Madhav Negi, Associate Director, Global PMO, Computer Science Corporation (CSC) spoke on the topic "Effective leadership".

This was followed by a talk on Future directions of IEEE Region 10: By Dr. Amit Kumar, Member – IEEE R10 SAC and a talk on Essential SB Operation Tools: by Dr.Y.Vijayalata, SAC – IEEE Hyderabad Section. A detail session was taken on vTools , the documents a Student Branch should maintain and events to be done to function effectively were covered by her. In the post lunch session there was a panel discussion on about IEEE Student Branches and their problems, this was chaired by Dr. N.V. Rao with Dr. Koduri Srinivas, Dr. M. Lakshminarayana and Dr. Y. Vijayalata as panelists.

Student Zonal Congress of Vizag Bay Sub Section

The zonal congress of Vizag Bay Sub Section was held on 4th December 2015 at GVP College. Mr. K. Ramakrishna, Director, Region 10 presented the keynote address. Dr. Murty P. Bhavaraju, delivered an invited talk on "Role of professional activities in the career". A panel discussion on "Role of Engineering Students in Make in India" was organized, where Dr. Koduri Srinivas, Dr. N. Lakshminarayana, Dr. Sastry V Vedula, Dr. N. Balasubrahmanyam, K. Sriram, CEO Sri Gopi Kumar Bulusu, and Dr. S. Lakshminarayana Chair IEEE Vizag Bay Sub Section participated.

Call for Articles

The IEEE Hyderabad Section endeavours to release four editions in a year and solicits the contributions from all IEEE members, chapters, student branches. The contributions should be in 400 words with two photographs with appropriate caption. They should be sent through email to arif.sohel@ieee.org

Ananthapur Student Zonal Congress

The IEEE Ananthapur Zonal Congress with theme of "Engineering for a Better Tomorrow" was aimed at providing a platform for all the student members of various student branches to integrate technology and innovation for a better and sustained tomorrow. The Zonal Congress focused on providing a platform to all student branches to come together, share their thoughts, ideas and the best practices, to learn and gain knowledge from each other, improve the overall functioning of the branches, and also give students an opportunity to interact with the people from various colleges and share common ideas and goals to attain the aims and goals of IEEE.

The congress was held on 29 – 30 December 2015 at Annamacharya Institute of Technology and Sciences, Rajampet, Kadappa. The Zonal Student Congress witnessed 300 participants from 10 different student branches of Ananthapur Zone. The Congress was amalgamation of Technical talks, Talks on Soft Skills and Lots of Interactive Sessions. The event was inaugurated by Chief Guest Prof. Allam Appa Rao, Director, C R Rao AIMSCS-UOH Campus and Guest of Honour Mr. Ramakrishna Kappagantu, Director Region-10 IEEE Asian Pacific Region. The other eminent speakers were Dr.Koduri Srinivas, Chair Hyderabad Section, Mr. Nivas Ravichandran-IEEE R10, Dr.Amit Kumar - IEEE Hyderabad Section, Dr. S M V Narayana - Principal AITS Rajampet, and Mr. Abhishek Reddy-AITS Rajampet. The focus was made on Entrepreneurship for young professionals by providing a forum and an opportunity for future entrepreneur to share ideas and to give a head start to their career growth.

Dr Y Vijayalata and Ms. Amita Kashyap had delivered a talk in forenoon on the second day. The third session was by Dr. M Lakshminarayana on Transmission lines and Electromagnetic Theory. In the Afternoon, an open forum on "Engineering for a Better Tomorrow" was held,it was chaired by Dr. V. Shankar-Professor-JNTUA Ananthapuram.

Dr. Ramakrishna Kappagantu and other dignitaries with the participants

Activities of IEEE Computational Intelligence Society

A Technical lecture by Dr. M. Naresh Kumar, NRSC Hyderabad titled "Advances in Computational Method for Decision Support " was organized on 07th Feb 2015, at MJCET Hyderabad. The talk focused on techniques for improving the predictive capabilities of a machine classifier in presence of noisy, incomplete and redundant feature sets. The speaker highlighted few examples pertaining to clinical decision support systems wherein the techniques were successfully employed in generating effective decisions.

A workshop on "Predictive Analytics with Rapid Miner" was organized on 22nd August, 2015 at GRIET, Hyderabad by Dr. M. Naresh Kumar, NRSC Hyderabad. The participants were given hands-on training in Data Mining techniques with rapid miner tool.

Dr. M.Naresh Kumar during the workshop

A technical lecture by Dr.Iswar Chandra Das, NRSC titled "Statistical and Computational Methods in Geospatial Modeling "was organized on 29th December 2015 at JNTU, Hyderabad. The talk focused on application of statistical techniques such as logistic regression in spatial domain for understanding earth system processes such as landslides.

Important Information

Dr. S.C. Bhargava has uploaded a video on the YouTube that describes comprehensively the entire process of building one's own solar panel(s) starting from the basic photo voltaic cells (or PVCs) to convert solar energy into electricity. The video is titled "SCB solar electricity". Duration: about one hour.

For any questions/comment/clarification, please contact: bhargavasc41@gmail.com

Activities of Joint chapter of IEEE MTT/AP/EMC-S

A Three Day National Level Workshop on ANTENNA DESIGN & SIMULATION WITH HFSS S/W was organised by IEEE Hyderabad Section's MTT/AP/EMC-S Joint chapter in association with Geethanjali Institute of Science & Technology-Nellore during 19th-21st Sept 2015.The workshop comprised of technical talks by Dr. N. V. S. N. Sarma, Professor, ECED, NIT WARANGAL-on FDTD Simulation studies & Fractal antenna design concepts. This was followed by a talk on Reconfigurable antennas by Dr. M. Lakshminarayana-Vice Chair-IEEE HYD. Finally, Dr. Nukala Srinivasa Rao, Chairman-MTT/AP/EMC-S Chapter, gave a talk on Metamaterials & applications to antenna . 65 delegates attended this workshop from across the country.

The J C BOSE Memorial Lecture was organized on 30th NOV 2015 at Osmania University. Dr. Debtosh Guha, Professor of ECE, IIT, Kharagpur gave a technical talk on Invention of Radio and wireless signal transfer.

Dr. Debtosh Guha with members of MTT chapter.

IMARC2015(International Microwave and Radio Conference) organized by IEEE-MTT-S USA & IEEE Hyderabad Section & IEEE MTT/AP/EMC-S Chapter of IEEE HYD SECTION was held from 10th to 12th December 2015.

A Distinguished Lecturer program on ' RADIATED TEST FACILITIES ' ,by Dr. Vignesh Rajamani, Vice President-IEEE EMC-S -USA was held at Vasavi College of Engineering on 16th December 2015. Around 200 members participated. There was a repeat lecture on 17th December 2015 at Matrushri Engineering College.

A one day workshop on RECENT ADVANCES IN SATELLITE PAYLOAD ANTENNAS at MARRIOT HOTEL-Secunderabad on 29th December 2015. Six International speakers delivered technical talks during this workshop which including one on Satellite components exhibition. There were 32 participants in this workshop.

Activities of IEEE CAS/EDS Chapter

IEEE CAS Workshop – Collaboration event with IEEE CAS Japan and CAS Hyderabad

The IEEE CAS Chapter of Hyderabad section organised a one day Circuits and Systems Workshop in collaboration with IEEE CAS Japan on 31st November 2015 at Muffakham Jah College of Engineering and Technology. This workshop was sponsored by IEEE CAS Region 10 under the IEEE Outreach initiative. The workshop was proposed by IEEE CAS Japan and they received a sponsorship of USD 5000 for conducting this workshop and travel of Two faculty and four students from Japan to India. Dr. M.B. Srinivas, Immediate past chair, CAS Hyderabad liaised with CAS Japan for conduct of this collaborative workshop in Hyderabad.

The workshop started with the welcome address by Dr. P. A. Govindacharyulu, Chair, IEEE CAS Hyderabad. There were four speakers who were allotted thirty minute session each. Two speakers from Japan were Prof. Noboyuki Kasa and Prof. Hiroyuki Asahara and Two Indian speakers were Prof. Syed Azeemuddin and Mr. A.G. Krishnakanth. In the post lunch session, a poster presentation was organised in which thirteen students presented their papers of which four were Japanese presenters and nine were Indian students. The workshop concluded with Vote of Thanks by Dr. Kaleem Fatima, Vice Chair of IEEE CAS Hyderabad.

IEEE CAS Executive committee with Keynote Speakers

The IEEE CAS Chapter of Hyderabad section organised a technical talk on Chip design in Practice by Mrs. K Srisubha, Chip Engineering Lead, Redpine Signals on Saturday, 31 October 2015 at Seminar Hall, MJCET from 11.30 to 13.00. She described in the detail the practical design aspects involved in VLSI Design and the general issues faced during the design process. 110 members participated in this technical talk.

Dr. Mohammed Arifuddin Sohel presenting a memento to Mrs. K. Srisubha.

Distinguished Lecture and workshop by Dr. Vijay K. Arora

The IEEE CAS/EDS Chapter organized a Distinguished Lecture by Prof. Vijay Arora, Wilkes University, USA on the topic Quantum Nan engineering -Non equilibrium High-Electric-Field Transport for Signal Propagation at Osmania University on 19th December 2015. There were 25 participants in this lecture.

Dr. Vijay Arora delivering the DL

The IEEE CAS/EDS Chapter organized a one day workshop on Carbon the soul of Future Nan electronics by Prof. Vijay K. Arora, at Hotel karat Longspur, Begum pet on 20th December 2015. IT was attended by 15 participants.

Participants at the workshop on Carbon- Soul of future nanoelectroincs

Activities of IEEE COMSOC/SPS Chapter

The IEEE COMSOC and CAS chapters jointly organised a technical lecture on "Building Devices for the Internet of Things – with the WyzBee IoT Platform", on friday 16th October 2015 at MJCET. The talk was given by Mr. N. Venkatesh, Sr. Vice President, Redpine Signals. He elaborated the need for M2M communication and how the IoT is the next big wave in the communication and circuit's world. 130 members participated in this technical talk.

Mr. N. Venkatesh delivering the talk on IOT

The joint chapter of IEEE Comsoc/SPS Joint organised a Technical Lecture titled Digital Communications: Technology that Powers the Gen-Y Lifestyle by Dr. Kasyapa Balemarthy on 7th November 2015. Dr. Kasyapa holds a doctorate from Georgia Tech and is currently with OFS. Dr. Kasyapa presented a very good demonstration of how actual communication takes place and packet transmission is achieved over network existing across continents. Around 60 members attended this technical talk.

Elevation to Senior Members and Fellows

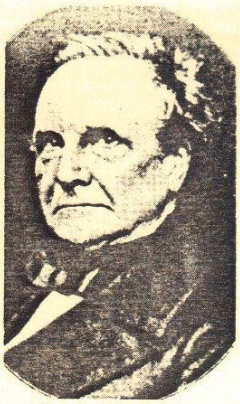
We would like to remind you to earnestly consider your elevation to Senior Members or Fellows in 2016, should you be eligible for it. For Senior Member elevations, kindly approach your friendly Section leadership to help with your application. As of August 2015, R10 has the highest number of Senior Member elevations. For Fellow elevation, it will be helpful if you have Fellows from your Society to nominate you. The recognition with achieving this status is priceless.

A contributed Article on

Charles Babbage: Architect of Modern Computers

Dr. N.V. Rao, Senior Member of IEEE Hyderabad Section has contributed this paper on Charles Babbage on the occasion of his birthday in December. The paper was originally published in Hyderabad section Newsletter in 1991 and Dr. N.V. Rao was the chair , SAC.This may be available now in the internet, but in 1991 it was compiled based on references. It is reproduced here as an Archive from past.

Charles Babbage : Architect of Modern Computers



Charles Babbage
(26 Dec. 1791 - 18 Oct. 1871)

Charles Babbage is one of the most remarkable figures in the history of computing machines. Of all the pre-20th century contributors to the development of computing, he came closest to actually inventing a computer in the modern sense. He designed two computers: The Difference Engine (conceived in 1823) and the Analytical Engine (conceived in 1834),both of which represented fundamental advances. On his 200th birth anniversary, he is being remembered this year for his massive contribution as the founding father of modern computing.

Charles Babbage was born in a wealthy Devonshire family, in Teignmonth, England on December 26, 1791. He was educated at Totnes and at Trinity college, Cambridge. He had received his training as a mathematician in company with such distinguished colleagues as John Herschel and George Peacock. These three had founded Analytical Society of Cambridge, whose purpose was to introduce developments from Europe into English mathematics and also to combat the dot-age of Leibnitz and support the de-ism of Newton - these two terms referring to the rival symbolisms used in the differential calculus. He occupied for 13 years the same Cambridge chair of mathematics once held by Isaac Newton, yet in all that time, he never lived there or delivered a single lecture. He was a founder member of Royal Astronomical Society. Among his other eminent friends were Michael Faraday, Charles Darwin, and George Stephenson.He was a genius and a remarkable prophet of the techniques of Operational Research.

But the cause that ultimately governed Babbage's life was the pursuit of mathematical accuracy. He with Herschel made a crusade out of spotting errors in the published log tables professionally computed for the Royal Astronomical Society and are used as calculating aids by astronomers, mathematicians and navigators. At one point, weary of the errors, Babbage expostulated "I wish to God these calculations had been executed by steam." "It is possible " replied Herschel, setting babbage on the quest for the calculating engine. His passion for the calculating engine, according to reliable accounts, developed around 1822. He became convinced that it should be possible to make machinery that would compute by successive differences and set type automatically so that tables could be printed without the errors produced by the intervention of an operator. In the same year, Babbage wrote a scholarly paper describing a machine that could compute and print lengthy scientific tables. He built a preliminary model of his Difference Engine as he called his machine, made with toothed wheels on shafts turned by a crank. He enlisted the Royal society in a bid for government grant to construct a full-scale working version. To the society, he wrote that the machine would take on the "intolerable labour and fatiguing monotony" involved in repetitive mathematical chores; these rank among the "lowest occupations of the human intellect". The society judged his work as "highly deserving of public encouragement".

The pilot model of his first Difference Engine won a gold medal from the society and a government grant of £1500 for the project. He intended his machine to calculate the entries of a table automatically and transfer them via steel punches to an engraver's plate, from which the tables can be printed. Only addition was performed. By the method of "finite difference ",

it. The finished machine could have been as big as locomotive, its insides an intricate mass of intermeshing steel, brass and pewter clockwork, all driven by steam. The least imbalance in the smallest part would have been multiplied hundreds of times of Over, dooming the machine to violent seizure.

Analytical Engine was never built. All that exist of it are its plans, drawings and a small portion of mill and printer built by Babbage's son. However, the ideas were so sound that they may still be found in electronic computer. In 1848, he made yet another major change by going back to a second model of Difference Engine. Several modest Difference Engines were successfully completed. Babbage himself built a smaller version, parts of it are now in South Kensigton Science Museum.

In 1834, getting a copy of one of Babbage's articles on the Difference Engine, A rich stockholm printer George Scheutz (1785 - 1873) and his son Edward with some financial assistance from their government and National Academy, set about building a machine and brought it to a successful conclusion. They made their first practical model in wood, wire and pasteboard in 1834 and by 1837, the son has built a working model in metal. In 1840 they had a machine which worked to 5 digits and calculated first difference. In 1842, they could calculate third difference and by 1843 an automatically printing version had been successfully made. A final version incorporating all improvements handling third-degree polynomials and 15 digit numbers was ready by 1853. Babbage finally saw his creation perform in London in 1854.

In 1855 Scheutz's Difference Engine won a gold medal at the exhibition of Paris and to the surprise of the makers, their most fervent admirer and supporter was Babbage himself. In the following year the machine was bought for £5000 by an American businessman, who presented it to the newly built Dudley observatory in Albany, Newyork. A few years later, the British government that backed out and abandoned Babbage, commissioned one for its Registrar-General's department.

The Difference Engines of Babbage and Scheutz provided a new sort of automation of mathematics giving a new concept of a continuous series of operations, of the taking of differences that could be used to automatically build up a printed table for almost any mathematical (regular analytical) function. Hence Difference Engine is often referred as the first modern mathematical machine.

Just 19 years after his death, one aspect of Analytical Engine - Punched Cards - appeared in a statistical tabulator built by American Herman Hollerith to speed up the process of returns for the 1890 U.S census. He found the Tabulating Machine Company to sell his invention, which finally became in 1924 IBM Corporation, after number of merges and changes.

More than a century after Charles Babbage's struggle with the Analytical Engine, IBM became a world leader in an industry that has brought to life his vision of " a machine of the most general nature". Even Babbage's fertile mind could not have foreseen the forms his dream machine could ultimately take. Later during 1942-44 with U.S. Navy's blessings and IBM's money and engineering support, Howard Aiken, a Harvard mathematician built MARK-I, out of untested 19th century concepts and proven 20th century technology. Babbage's original description of his Analytical Engine was a more than adequate guide. "If Babbage had lived 75 years later, I would have been out of a job," said Aiken afterwards.

Babbage wrote on varied subjects and helped to develop many practical devices. Some of his inventions are listed below :

- A flashing beam system still used in light houses, worldwide.
- Stage lighting (he even wrote a ballet to demonstrate its viability)
- A cow-catcher for trains.
- Improvement of safety of Brunel Railways
- An early ophthalmoscope
- Thief proof locks.
- Tachometer

His other accomplishments include:

- Establishment of modern postal system and its reforms in England.
- Problems of mortality rates.
- Techniques of operational research.
- Compilation of the first reliable actuarial tables.

He was a leader of Science reform moment and authored two books. "On the economy of machinery and manufacturers" and " Reflections on the decline of science and its causes". He wanted that reformation of society should start with schools and colleges. He wrote on

a large number of useful functions can be calculated, using only addition, as any continuous function can be approximated as closely as desired by a polynomial.

Babbage proposed to build a Difference Engine that would accommodate sixth-degree polynomials and 20 digit numbers. The project was begun in 1823 and abandoned in 1842, despite an enhanced grant of £17000 from the government. He originally expected to finish it in three years, but the Difference Engine grew increasingly complex as he modified, enhanced and redesigned it. Labour, health and money problems beset him. He had a fiery quarrel with Clement, his engineer - resulting in the stoppage of work. He failed because of inadequacy of the mechanical technology available at that time. Babbage lost interest in the Difference Engine, when he conceived of a much powerful and ambitious machine Analytical Engine, that would transcend the Difference Engine and all other mathematical machinery. The Analytical Engine was designed to carry out a wide range of calculating tasks according to the instructions supplied by its operator (program). It was to be a machine of the most general nature - in fact nothing less than the first general purpose programmable computer.

The Analytical Engine consists of two parts a mill and a store, both composed of cogs and wheels. The store, a memory unit hold up to 100 forty digit numbers at a time. Numbers would be kept in the store until their turn came to be operated on in the mill; results would then be moved back into the store to await further use or to be printed out. The mill - which corresponds to a modern ALU, was to be capable of performing the four basic arithmetic operations. In order to control the sequence of operations of the machine, Babbage proposed to use punched cards of the type developed earlier for the Jacquard loom. The cards which constituted a computer program were divided into two groups.

1. Operation cards used to control operation of the mill, each card selected one of the few possible operations (+, -, x, ÷) to be performed at each step in the program.
2. Variable cards intended to select the memory locations to be used by a particular operation i.e. the source of the input operands and the destination of the results.

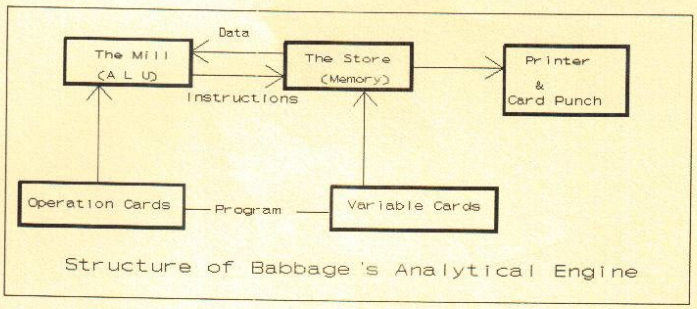
Provision was also made for supplying numerical information such as constants either by punched card or by manually setting counter wheels. It was intended to have output on punched cards or printed on paper. These elements are essentially identical to those found in modern computer - yet they were not discussed until more than a century later.

Babbage's more significant contribution was a mechanism for enabling a program to alter the sequence of its operations automatically. In modern terms he conceived the conditional branch (sign test) instruction. He also proposed a mechanism for both advancing and reversing the control cards to permit branching to any desired instruction.

The design of the Analytical Engine embodied all features essential to a general-purpose automatic computing machine. He proposed to build it on a grand scale. The store was to have a capacity of 1000, 50 digit decimal numbers. He estimated the addition of two numbers would take a second, multiplication one minute. Babbage spent much of the latter half of his life and most of his fortune refining the design of the Analytical Engine and trying to build it. Only a small part of the machine was actually constructed.

Augusta Ada, daughter of the poet Lord Byron, the Countess of Lovelace lent her considerable talent for mathematics and writing to Babbage's project. She comprehended both the methods and its vast potential for application. What she understood best was machine's radical conception - that was a mathematical jacquard loom, essentially empty, but capable of executing any pattern or program that could be translated onto punched cards. She wrote "we may say most aptly that the Analytical Engine weaves algebraic patterns just as the Jacquard-loom weaves flowers and leaves". Babbage even declared " Lovelace seems to understand Analytical Engine better than I do and is far better at explaining it ". Thus Lovelace helped Babbage to clarify his ideas and boosted his spirit by her interest and enthusiasm.

If Difference Engine had been a doubtful preposition, the Analytical Engine was an impossibility. Parts could not be made to assemble and run



Structure of Babbage's Analytical Engine

a wide range of subjects philosophy, geology, archaeology, optics, light house, armaments, postal services, chess, social reforms, technology, politics and manufacturing systems. He was hailed as "the great English Polymath", widely accomplished in the arts and sciences everything from philosophy to lock-picking.

He campaigned against Organ-grinders whose noise he used to hate. When he died "London Times" described him as a man who had survived to almost 80 in spite of Organ-grinding persecutions.

His pursuit of accuracy and spotting errors can be seen by the following incident. He wrote once to the poet Alfred Lord Tennyson for his lines "Every moment dies a man/every moment one is born", suggesting that the lines would be better and more truthfully read, "Every moment dies a man/every moment one and one sixteenth is born" since the population of the world was not constant.

His bicentenary celebrations mainly centered at London and his place West Country.In the science museum at London, a five - month exhibition started on 1st July. A full scale version of Babbage's second Difference Engine was built at a cost of $300,000 for exhibition. The massive engine is expected to bring out the contrast between early country machines and today's miniatured calculators. It was assembled from 4000 parts and it weighs 3 tonnes. It is 11 feet long, 7 feet high and 18 inches deep. The project involving Imperial college, is significant because it has been built for the first time 150 years after it was designed. According to the project, "Babbage's engine is built to original designs to prove that these machines could have worked in his days. This is a unique opportunity to redeem the greatness and rewrite history in the process". Also exhibited are the three surviving assemblies of the engine built by Babbage.

The bicentenary celebrations also include

- An international conference on past, present and future of computing.
- A six part series "The Information Age" to be shown at British and American Television.
- A touring exhibition covering the history of computers, opened on July 9 at Totnes, an old south Devon town, which was Babbage's ancestral and boyhood town. A room in Elizabethan Museum in the town is dedicated to Babbage's memory and achievements.

Charles Babbage was a genius and a dreamer who clearly visualized a general purpose computer, complete with a flexible programming scheme and memory units. He failed mainly because of technology limitations. He died on October 18, 1871. His main legacy however lives everywhere in the world especially as a tool for scientific, technical, and commercial applications.

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Compiled By :

N vyaghreswara Rao
Chairman,Student Activities Committee,
IEEE Hyderabad Section