From the HoD's desk

The mediocre teacher tells
The good teacher explains
The superior teacher demonstrates
The great teacher inspires

- William Arthur Ward

Dear Reader,

On coming back to Kerala after working at Bangalore for 12 years, I had the opportunity to meet some of my teachers whom I remember with affection and reverence. It could be their influence which brought me into this field. Teaching is the noblest profession.

Let me share an anecdote. A famous jewellery store had many emeralds, rubies and precious stones. One of the tourist's attention was drawn to a dull stone kept along with these shining stones. Having wondered why the stone was displayed in the store, he approached the shop keeper.The shop keeper did not answer, but held the stone tightly in his hand. Moments later, the stone glowed and had luster. It was an opal. It needed 'human touch' to bring out its beauty.

What are the qualities of good teachers which make them special? Let me think of the qualities my teachers had. Definitely they had thorough grasp of the subject, had patience, encouraged us, and prepared us for exams, interviews and for real life. They taught us values. They conveyed a message that inspite of the various challenges faced by them, they consider teaching as a very rewarding experience. Indeed they were sincere and committed to their work . They worked not only for salary but also for making our lives better. They were not employees who worked only during official hours, they worked continuously with us.

 According to Swami Vivekananda: He alone teaches, who has something to give, for teaching is not talking, teaching is not imparting doctrines, it is communicating. All teaching implies giving and taking. The teacher gives and the taught receives, but the one must have something to give, and the other must be open to receive.

Introducing journals: *Resonance*

Resonance is a journal of science education, published monthly by the Indian Academy of Sciences, Bangalore. The journal is primarily directed at students and teachers at the undergraduate level, though some of the articles may go beyond this range.

Features

Each issue of Resonance contains articles on physics, chemistry, biology, mathematics, computer science and engineering. The format is attractive and easy to read, with photographs, illustrations, margin notes, boxes and space for comments provided. The articles are of various categories: individual general articles, series made up of several parts, concise article-in-boxes, classroom pieces, nature-watch pieces, research news, book reviews, and information and announcements useful to students and teachers. Each issue of Resonance also highlights the contributions of a chosen scientist, engineer or mathematician, with a portrait on the back cover and articles describing his or her life and work. In some cases, an article written by a scientist on a general theme is included as a Classic or a Reflections item. Some of the personalities featured so far are — Einstein, Schroedinger, Pauli, Chandrasekhar, Raman, S N Bose, von Neumann, Turing, Darwin, McClintock, Haldane, Fisher, Lorenz, Mendel and Dobhzansky.

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The time is always right to do what is right
- Martin Luther King Jr.

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Observations/Comments

[A column by PRM]

I would like to discuss a few pints related to electronics circuits lab activities in this issue also. It is about debugging the circuits [I do make an apology here that I am not sure how far this usage of 'debugging' is true with respect to circuit hardware part; but this usage has become so fashionable that I too feel the internal compulsion to use it.].

We do the wiring of circuit, mostly on bread board, after confirming the design. Is it necessary that the circuit that we hook up gives the desired result, just because the design has been checked and confirmed? Very often, if not most often, we find that the circuit does not give any response at all, or it just gives something unexpected.
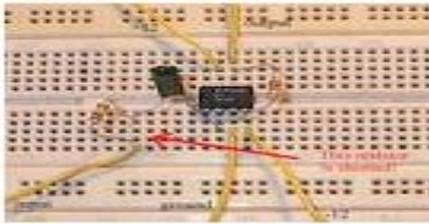
What do you do then? Sometimes you check the connections. Sometimes you meddle with the oscilloscope settings. In any case, most often, I've not seen a systematic approach being adopted. Very often the tendency is to dismantle the whole set up and redo the circuit. In the second attempt you may end up getting the expected response. You may become happy then. But please remember that, with such an approach, you are not aware of what was really wrong, because of which, you are not able to ensure that the same mistake or error will not occur again; may be, it could happen again while doing it for the lab exam! Make it a point to learn from all failure experiences. Experience becomes the best teacher only if you analyse the failures, work out the possible reasons for failures, find out the root cause, and take measures to eliminate/avoid such errors/mistakes in future. A systematic approach is most important.

After confirming that your design is ok, you collect the components. Make sure to check all the components before you start wiring. Note down all the component values. Work out the variations you can expect in the responses because of the observed variations in the selected components. That may help you in debugging later. After wiring, first check for the correctness of wiring. Inspect every connection to make sure that it actually connects. Make sure that the placement of components is ok. Very often resistances get interchanged while wiring. Similarly, make sure that the polarity of electrolytic capacitors is right.

Check all connections that go to ground/common. Make sure that all points that are supposed to go to ground really do.

After confirming correctness of wiring, see the power supply settings and connections. Make sure that your oscilloscope probe is ok.After powering the circuit, make sure that all points that are supposed to receive power really are getting power by measuring with a voltmeter. Then check the dc conditions. If you find that the dc conditions are much different from the expected ones, see why it could happen. May be that you have assumed a â value for the transistor, which is much different from the actual one.

If your circuit uses an IC, confirm that all pin connections are right, measure the pin that gets Vcc(+) and Vcc(-),and make sure it's getting power.

Make it a point to note down, neatly and legibly, all your observations regarding the failure or deviations in performance.


Pulse code modulation of voice (G.711) – an overview

We have already seen compression of video and audio in detail. Now let us also look at how speech is compressed. Speech compression is usually done for telephony.

There are mainly two types of speech coders. They are waveform coders and parametric coders. Waveform coders are simple to implement, but the compression efficiency is not good. Waveform coders preserve the quality of the speech and speaker identification is possible if waveform coding is done. Parametric coders give better compression, but speaker identification is almost impossible. G.711 is a recommendation for PCM coding of speech. It is an example of a waveform coding. LPC is an example of parametric coding.

G.711 represents 8 bit compressed speech samples, sampled at 8000 samples per second. Since voice frequencies are in the range of 300Hz to 3.3KHz, sampling at 8000 samples per second is sufficient according to Nyquist criterion. G.711 encoder generates 64Kbps bitstream

Sampling results in discrete time signals. In order to convert these samples to digital, the amplitude has to be quantized. Quantization could be uniform or non uniform. Uniform quantizers are linear quantizers with boundary points equally spaced. In many cases, uniform quantizers are not optimum in terms of the distortion introduced. Non uniform quantizers increase the dynamic range of the signal that can be accommodated within the allocated bits by taking into account the input characteristics of the signal. A model of a non-uniform quantizer is shown in the figure.
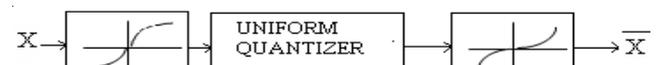
Fuzzy logic

Fuzzy Logic has been gaining increasing acceptance during the past few years. There are over two thousand commercially available products using Fuzzy Logic.

Fuzzy logic is a powerful problem-solving methodology with a lot of applications in embedded control and information processing. Fuzzy provides a remarkably simple way to draw definite conclusions from vague, ambiguous or imprecise information. In a sense, fuzzy logic resembles human decision making with its ability to work from approximate data and find precise solutions. Thus it is very much associated with artificial intelligence.

Unlike classical logic, which requires a deep understanding of a system, exact equations, and precise numeric values, Fuzzy logic incorporates an alternative way of thinking, which allows modeling complex systems using a higher level of abstraction originating from our knowledge and experience. Fuzzy Logic allows expressing this knowledge with subjective concepts such as very hot, bright red, and a long time, which are mapped into exact numeric ranges.

A fuzzy logic controller consists of an input stage, a processing stage, and an output stage. The input stage maps sensor or other inputs like switches to the appropriate membership functions and truth-values.

 Let us have a look at a simple fan speed controller. Say the temperature sensor output varies between 1 to 5v. This range is divided into say, six different linguistic variables, too cold, very cold, cold, hot, very hot, too hot etc. These variables are very subjective and are mapped to appropriate membership functions of any shape, like triangular, trapezoidal etc. The shape is generally less important than the number of curves and their placement
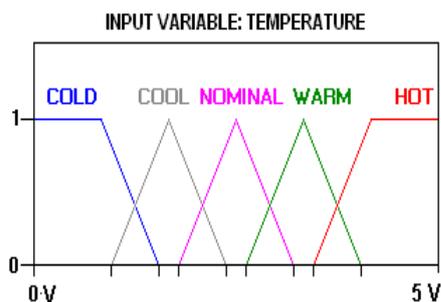
The processing stage is based on a collection of logic rules in the form of IF-THEN statements, where the IF part is called the "antecedent" and the THEN part is called the "consequent"

For example, IF the temperature is WARM THEN fan speed is VERY FAST

The processing stage invokes each appropriate rule and generates a result for each, then combines the results of the rules based on a neuro-fuzzy system. Neuro-fuzzy system is a combination of artificial intelligence and fuzzy logic. The strength of neuro-fuzzy systems is characterized by two contradictory requirements in fuzzy modeling: interpretability versus accuracy. In practice, one of the two properties prevails. The neuro-fuzzy in fuzzy modeling research field is divided into two areas: linguistic fuzzy modeling that is focused on interpretability, mainly the Mamdani model; and precise fuzzy modeling that is focused on accuracy, mainly the Takagi-Sugeno-Kang (TSK) model. Here we are dealing with Mamdani model. The output stage converts the combined result back into a specific control output value by defuzzification. There are many methods for defuzzification like centriod method, height method etc.
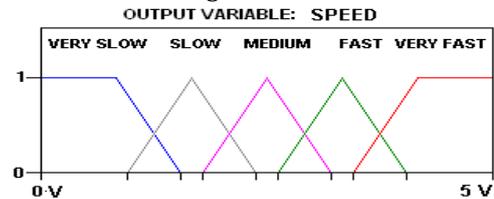
Thus the controller output becomes 0V to 5V which can be interfaced with the fan to control the speed.

Many consumer goods incorporate fuzzy systems. Matsushita vacuum cleaners use micro controllers running fuzzy algorithms to interrogate dust sensors and adjust suction power accordingly. Canon developed an auto-focusing camera that uses a charge-coupled device (CCD) to measure the clarity of the image in six regions of its field of view and use the information provided to determine if the image is in focus.

What makes consumer electronics companies to go for fuzzy based system? Fuzzy Logic reduces the design development cycle by simplifying the design complexity. Thus improves time to marke

-Jino

...continued from page 2

The input signal X is passed through a compressor and then quantized and then passed through an expandor.Compressor compresses large amplitude signals. Expandor does the reverse and expands the large amplitude signals. The term compandor is used to represent the above model consisting of compressor, uniform quantizer and then expandor.

G.711 standard has A law and Mu-law companding algorithms. A-Law encoder converts 13 bit linear PCM samples into 8 bit compressed PCM (logarithmic form) samples. It is mainly used in Europe. Mu-Law encoder converts 14 bit linear PCM samples into 8 bit compressed PCM samples and is widely used in America.

- Meena

An Open Invitation for Root Cause Analysis

Have you read the news on the sad demise of a young engineer during an adventure sporting attempt in Bangalore? I read it in the Bangalore edition of 'The Times of India' on 2009 April 12. The news read like this: "Experience life with just one string attached', declares the website of Head Rush Bungee, an adventure sports company operating near Bangalore. For 25 year old Bhargava V, a marine engineer from Chennai,that single string snapped, sending him plunging to his death in a shocking bungee jumping accident. What's even more shocking is that there was no safety net or ambulance, nor even a first-aid kit available with the organisers. Again on the great Vishu day,2009 April 14, there was a review article with the main title : "Nobody looks after adventurers" along with a subtitle: "DESPERATELY NEEDED: Regulatory Body for Such Sports in India".
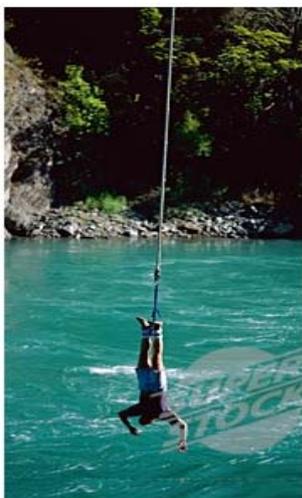
Such incidents are not very rare in our country. News papers, other media, concerned bodies of government and voluntary organisations become wise after such incidents, though temporarily! That wisdom make them publish materials such as this:

"*The organisers of the bungee camp, the Centre for Adventure and Rejuvenation of Environment (CARE) and Head Rush Bungee, had not taken a No Objection Certificate (NOC) from the police to conduct such an event. The police have registered a case of negligence under IPC 304A against the companies and have arrested Sachin Venkateshaiah from Head Rush Bungee.*"

Can you please spend some time to do a failure analysis in an engineering way, and find the root cause.

Please submit your analysis for publication in the next issue.

-PRM

Bungee cord is generally made of a number of strands of an elastic material, usually rubber, bound together by a fabric covering. It is commonly used as a tie-down for luggage or equipment carried on the outside of a vehicle. Bungee cord is also used by the military to absorb the opening shock of the large cargo parachutes when dropping heavy loads such as tanks. Bungee cords find application in recovering articles safely in separation tests on large and heavy separation systems of rockets.The development of long, heavy-duty bungee cord for the military led to the adventurous sport of bungee jumping. In this sport, the participant jumps from an elevated structure while wearing a harness attached to one end of a long bungee cord with the other end attached to the structure.

The term 'bungee' or 'bungie' is thought to be British slang for India-rubber. Some references to the India-rubber originally used for erasing pencil marks on paper call it "India-bungee". Another source claims the term was derived from the Anglo-Indian word "bangy" referring to the colloquial term for a yoke carried on the shoulder with two equal loads suspended by cords front and rear. In either case, the concepts of an elastic material and load-bearing cords both apply to the modern bungee cord.

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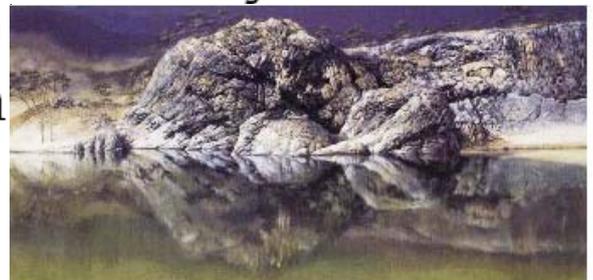
What is spectacular about this picture?
First correct answer will win a prize.

Answer to the question in the previous issue
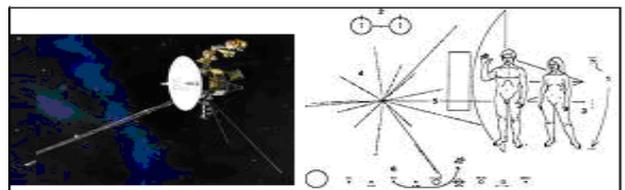
This is the *Pioneer10* spacecraft, first human-built object to leave the solar system. It consists of a gold anodized aluminum plaque, which gives an information about the relative position of the Sun to the center of the Galaxy and 14 pulsars. The mission is to find the extra terrestrial life.