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My CV

Erik Margan
(auto-caricature, MsPaint,
128x128 pixels, 2 colors)

Contrary to widespread belief, when I was born, back in 1954, I was very young and inexperienced. It took me four years to recognize that the world as we know it was not well designed from the beginning (if you ask me, I think that the beginning of everything was owed to an experiment that went out of control — otherwise there would not be any Big Bang in the first place!) and that we should do something to improve it.

I started that improvement by educating people who were close to me — my parents. But after two years of unsuccessful trials I finally gave up and decided that social engineering is definitely a blind alley.

So I started experimenting with objects around me, and I remember how enthusiastic I was to discover that objects did not make complains when you smashed them. Better still, they did not make complains even if you ignored them. It was a nice discovery.

My parents noticed my interest in things and soon I was receiving didactic toys for birthdays, New Year, and other holidays. For my eighth birthday I got a big 'Electro–Pioneer' box. For a while I enjoyed playing with the magnet and iron dust. Pretty soon there was iron dust everywhere, but, fortunately for me, it could be collected easily — with the magnet, of course. Too easy and not much fun.

But then I found a battery and a 3 V lamp and — there was light! Now, that was something! But not for long, though: the battery was out in less than an hour. I went to sleep that night thinking how wonderful it would be to have an inexhaustible power source.

At five in the morning I was up with a new idea. In less than ten minutes I put together a lamp in a socket, a switch, wires and a plug, and connected it to the 220 V AC mains. Then I pressed the switch.

The effect was, well, lightning. But I was disappointed. Certainly, the makers of 3 V lamps should be forced by law to put on a warning to the customers that they will be violating the user's license by exposing the lamp to higher voltages. But, hey, that was in the early sixties, when nobody cared much about anybody's rights anyway.

The big bang of the unfortunate lamp and the 10 A fuse woke up my mother and she came to see what the hell our neighbors were up to. I told her it was nothing and that she could go back to sleep and I will clean up the mess.

Then my mother gave me the first lesson on electromagnetic theory. It was a painful experience, but it was worth it, otherwise you would not be reading this and gaining from my experience. Clever people do learn from the experience of others and not their own, so I was told. But that was on another, less dramatic occasion, and I never thought twice about that. Until it was too late.

I remember how happy I was whenever I could have some first hand experience of anything in connection with electricity. Most of the time I got 'smoked up' with blown electrolytic capacitors, burned by touching hot resistors, vacuum tubes, and later power transistors, shaken a few times by touching the AC mains, destroyed a few pieces of furniture with the soldering iron and a few carpets with solder drops. I was making all sorts of errors, so I was learning very fast. Only much later did I realize how thoughtful of me it was that I did not follow the wishes of my father to go for a medical profession, or become a chemist, like my mother.

Later in school my pace of learning slowed down considerably, since all my teachers were trying hard to discourage that kind of acquiring knowledge. And they almost succeeded. But in 1968 I joined the orthodox rocker movement and adopted the 'flower power' philosophy. I was playing a guitar, daydreaming of making my own amplifier, with all the psychedelic sound effects built in, which even *Jimi Hendrix* himself would envy. Then the *Manson* 'family' killed *Sharon Tate* and her friends. Of all the flower power, only the flower powder remained. But I was still making amplifiers. Gradually, I became an 'audiophile', a Hi-Fi fan, but with a highly technical inclination. I think I have spent more time listening to amplifier distortion than to music. Which is a shame!

At that time oscilloscopes were a rare commodity, even amongst professionals, and like many of my colleagues most of my experience came from my ears and from a modest AVO meter. But I managed to build a few circuits (one of them was the differential distortion measurement circuit, published by *Peter J. Baxandall* in Wireless World) which expanded the instrument measurement capabilities and resolution enough to do some serious distortion analysis.

In 1981 I started to work at the 'Jožef Stefan' Institute (http://www.ijs.si/), with a group of scientists under the leadership of Prof. *Robert Blinc* and Dr. *Janez Pirš*, doing research on liquid crystals, a very promising new technology. Soon I became involved in building driving electronics and various optical measurement equipment for our experiments (thanks, Janez, for trusting me!).

I witnessed the early success of LCDs: initially, the cost of a wrist watch with a LC display was nearly two month's wages of a general manager; three years later, you could buy a pencil with a built in LCD watch for US$ 1.95 and without the watch for 2.95! And I would not be surprised if the present mobile phone frenzy ends up by having a mobile phone as a surprise present in a box of detergent!

No, we were not responsible for this market overflooding. We were busy doing research on multiplex LCD driving and in 1982 we demonstrated the world's first 200 × 120 dot display. No one we have spoken to knew what to do with it, so we decided to make a small portable oscilloscope to show the money people more clearly what they will be investing in. The directors of Iskra, the major Slovenian electronics company, were interested and in autumn of 1983 we had a working prototype of the 'IskraScope LCD' at a local electronics fair.

Unfortunately, the German Metrabyte came up with a similar thing some two months earlier, so they collected the cream of the interest, because they were selling! Next year, we came up with a new model, 8–bit resolution, 2 MHz bandwidth, 2 M samples per second (S/s) in real time, and 10 MS/s in equivalent time, microprocessor controlled, with a membrane keyboard, a 2 k signal memory length, 10 screen long signal memories, to which you could apply some rudimentary math, a built in $3\frac{1}{2}$ digit DMM, an analog XY plotter output, and a galvanically isolated RS-232 serial digital interface, with a 6–hour battery life, and a mass of 2.5 kg. Again, it was a fine prototype. But Metrabyte was still selling strongly its last year's 250 kHz model. For the next few years, people of Iskra–Commerce went from one fair to another showing the prototypes, but they never knew what to say to a potential customer asking by what time they could make 1 k pieces and for how many kUS$. Then, in 1987, Sony came in with their 50 MHz handheld model (later sold under the Tektronix trademark) and we were out.

Moral: never show a prototype to anyone but your own boss!

Although we have tried to revive the project, first as an optical time domain reflectometer using a 20 MHz ADC (with which we could measure a 0.5 dB optical mismatch in a 50 km fiber and locate it within 1 m resolution in real time), and later as a data acquisition unit with a small nuclear magnetic resonance imaging device, Iskra was never interested enough, mostly owing to the general financial crisis and the galloping inflation in ex-Yugoslavia.

It was in those years that I came to know *Peter Starič*, who was then also working at IJS, but in a different department. Since I was involved mainly in designing the analog input and the data acquisition part of the 'scope, his fresh memories of what he had done at Tektronix, as well as his rich library, which he was sharing generously, helped me a lot.

Later Peter went to the 'Milan Vidmar' Institute (http://www.eimv.si/), where he started to work on a project of renewing the then manually adjustable *Marx* generator (no, not *Karl*, but *Ernst*!) and turn it into something that could be remotely controlled. For those not familiar with Marx (no, not Karl!), his generator is a cascade of capacitors, 8 in our case, charged in parallel to some 100 kV and then connected in series by firing spark gaps, producing a 1.2 μs rise, 50 μs decay, 800 kV, and more than 50 kA peak current (~2 megajoule) impulse, by which the electrical power insulators are tested for breakdown under lightning strike conditions. Knowing of my work on digital data acquisition, Peter decided to invite me to help him, as digital electronics was out of his domain of interest (mine too, actually, but I had to become accustomed with it out of sheer necessity).

A few years later Peter retired and I took over, thanks to the invitation from the EIMV director, Prof. *Maks Babuder*. You can not imagine how nice it was to revive my memories of the unfortunate 3 V lamp, but on a much, much larger scale! When the isolation being tested breaks down, the Marx generator flashes a 60 cm (about 2 feet) long arc with a bang of a small clap of thunder! The problem with recording any event with such a signal is that there is no 'ground' reference — everything floats at many tens of volts or even a kV, depending mostly on the inductance of the particular ground path and the capacitance of a surface. You can not just connect two instruments together — the transients within the loop formed by the signal connection and the grounding power cables can be high enough to destroy both

instruments. And we did not have just two instruments: there was the motor and the electronic servo-control driving the variac for the high voltage charger, the stepper motor for adjusting the spark gaps, measured by a 13 bit displacement encoder, the DC HV meter, the high speed digital oscilloscope, the laser trigger, the PC which was controlling everything, and a number of safety devices, the most important of which was the short circuit discharge, driven pneumatically. Now try to imagine the network of control signals and power supplies forming whatever loops they can, over an aarea of half a basketball field!

No wonder it was a miracle that on the first test no instrument failed — certainly, Mr. Edsel Murphy must have been sleeping after a hard day's work! But the EMI generated was such that it span some 7 'scope screens at nominal resolution — clearly too much 'grass' and no signal to measure. It took me and a colleague, *Marko Janša*, nearly two years of painstaking trial and error to find a configuration of connections, decouplers, filters, grounding and shielding by which we achieved an EMI attenuation of 130 dB, needed to make the measurements with a 1 % resolution.

Then, in 1994, I returned to IJS, this time to the Experimental Particle Physics Department, led by Prof. *Marko Mikuž*, where I became involved in an international collaboration at CERN, Geneva (http://www.cern.ch/). I joined the LEP/Delphi experiment, in which our department was participating, where we were designing and testing the hybrid readout electronics for the 'Very Forward Tracker' of the silicon vertex detector. Presently the LEP (large electron–positron collider) is being dismantled to make room for the new LHC (large hadron collider) and the Atlas experiment, for which I have designed some power distribution and detector electronics protection devices.

In a few years time, probably in 2007, the collider will be ready to recreate (in part) the conditions present at the birth of the Universe. If you will then hear the news that 'the scientists at CERN have made a Big Bang again', you will know who to blame for it!

Erik Margan

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