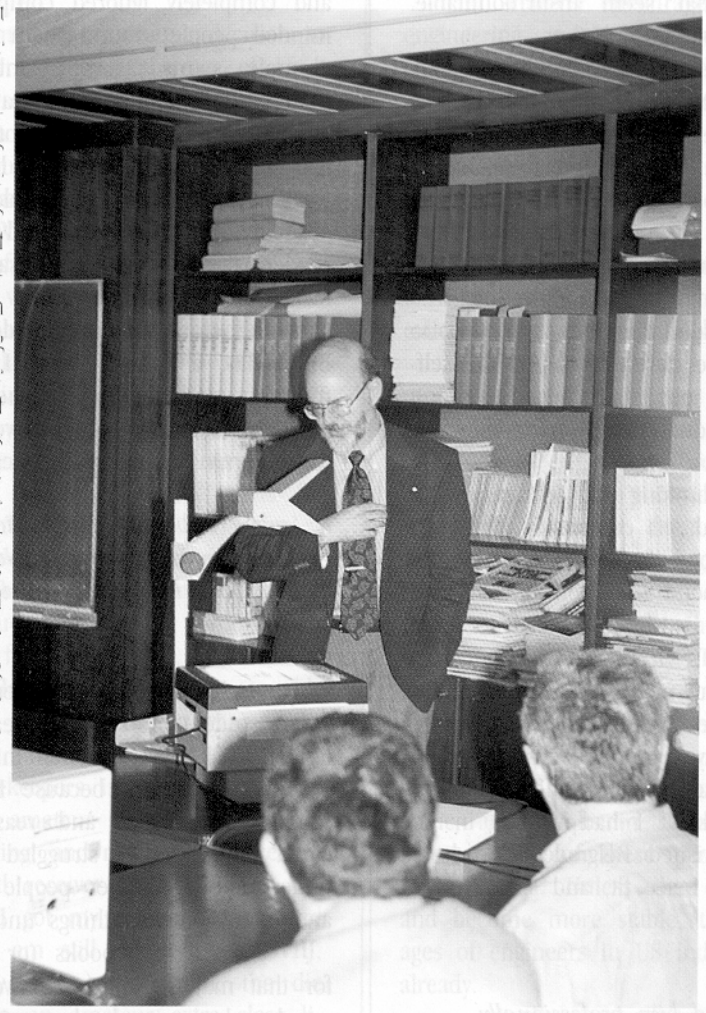
The Man Who Was Born to Be an Engineer – Steve Maas

In November last year, the Yugoslav IEEE MTT-S Chapter had an exceptional opportunity to invite Prof. Steve Maas to visit Belgrade and give the lecture entitled: "Planar Double Balanced Mixers". At that time, Prof. Maas was lecturing at the Helsinki University of Technology in Finland and it was difficult to imagine a better chance for his old promise about visiting Belgrade to come true.



When the announcement about his lecture was sent to the IEEE MTT-S members and to the members of the Yugoslav MTT Association, the telephone in my office started ringing continuously. People were calling just to check if really THAT Steve Maas was coming to Belgrade. They could hardly believe that the writer of their favorite books „Microwaves Mixers" and „Nonlinear Microwave Circuits" was coming here, where even the IEEE publications were restricted to be send because of the UN sanctions imposed against Yugoslavia. But, I was not so surprised by his decision to come to Belgrade in those hard times. I remember clearly when I met him. It was during my first participation at MTT-S Administrative Committee meting in Boston in 1991. I do not know how I found myself sitting beside him, because I was so confused trying to understand what was going on, that I did not pay attention to the people around me at all. When the meeting well proceeded, I became conscious that on my right hand side there was a man who participated at the meeting, but from a certain distance. It seemed to me that he did not belong to that well trained team who were creating and making decisions in AdCom. When I turned a look to the right, my first thought was: Is THAT Steve Maas? I had already had his books on my desk and his face was familiar to me.

After that, we talked few times. This interview is just an attempt to summarize some ideas and thoughts about our profession given by the man who finds our work no fundamentally different from what artists, writers and musicians do, who made our profession more sophisticated than before and whose idea of fun is his work.

-I'm amazed that I survived all the bad advice given to me while I was young and I'll try not to do the same thing to other.

My first two jobs were in government-funded research centers. They were enjoyable, but I didn't learn much. I took jobs in these places, instead of industry, because my professors gave me the impression that only bad engineers took industrial jobs. The "elite" (meaning people like them, of course) took more "significant" jobs, i.e., research. (I still remember one professor sticking his nose in the air and saying, "We don't want to become hardware engineers!" Incredible!) This attitude delayed the beginning of my real education about six years. When I finally started working in industry, I learned how to design hardware that was manufacturable, reliable, and had good performance, and I learned how to use design reviews and establish the standards to ensure the same thing for an entire sys-

tem. Most important, I learned to survive in an environment where things absolutely have to work, and there is no alternative or excuse if they don't.

I think that every young engineer should spend a few years at a big company as early in his or her career as possible. this way he learns how things are done when success is absolutely necessary, the resources are available to achieve success, and failure is simply not an option. This way an individual learns how to make things that work, develops the confidence to face and solve any problem, and ways to assemble other resources (primarily other people) to help solve problems that seem insurmountable. After that, anything is possible.

This is part of the reason I didn't last long in Academia. My greatest disappointment (among many) with UCLA was the lack of commitment to undergraduate education. In the US, most academics go straight though college, receive a Ph.D., and go directly into the university. As a result, few of them know anything at all about real-life engineering. Teaching undergraduates brings this ignorance out into the open, so it is little wonder that they don't like to do it. Additionally, most have never developed the self-discipline necessary to do jobs that they just don't like, and teaching undergraduates well requires a lot of hard, thankless work.

I went into UCLA thinking that I knew exactly what good teaching was, and left completely unsure. I sometimes think that even bad teaching has, its value-it forces the student to depend more on himself and less on the teacher, which is what we need to learn to do eventually.

I've finally found my niche as a consultant. I like consulting work because of its challenges, variety, and the fact that I do only technical work. I have a lot more freedom; for example, I could not have spent a semester in Helsinki if I had worked in industry, and couldn't have visited Belgrade. I work at home, organize my time as I see fit, and spend more time with my wife and sons.

About people who influenced him professionally

-A few teachers had a strong influence on me. These didn't influence what I did as much as how I did it. For example, Joseph Bordogna at Penn (the same person who ran for IEEE president last year) taught my first communication theory course, and gave me a good intuitive sense of the connection between time domain waveforms and their frequency-domain spectra. In subsequent years I've depended very strongly on this ability to move easily between time- and frequency-domain concepts. Another, John Orchard at UCLA, forced me to think about circuits in terms of the matrix representations of their equations-another skill that has been very useful. Finally, Nick Alexopoulos at UCLA taught me to be unafraid of large problems, because big problems are not necessarily hard problems. (The hard problems are the ones that you should be afraid of, and they're not always big ones!).

I've always admired and tried to emulate people who knew what needed to be done, did it, and completely ignored complaints from the small-minded people around them who set the styles. One example is my favorite painter Thomas Eakins, who lived in Philadelphia in the late 1800s. Eakins got into a lot of trouble by (among other thinks) insisting that his students learn anatomy by dissecting cadavers (a medical school was next door to the Philadelphia Academy of Fine Arts) and dead horses brought to rendering plants for disposal. He was eventually kicked out of the Academy, and was not allowed to show his work in the Philadelphia Word's Fair 1876. But today, a century later, I go the Philadelphia Art museum and delight in the intellectual depth and technical brilliance of his work. No one remembers the governing board of the Academy.

It was impossible not to ask the writer of „Microwave Mixers" and „Nonlinear Microwave Circuits" about his recipe for writing good engineering books.

-In school I was often jealous of those super-smart students for whom learning was almost effortless. Now, however, I often think that I was lucky that I wasn't so smart, because I had to learn to disassemble information and reassemble it in a way I could understand. I struggled to learn, and eventually understood how other people struggle to learn, too, and how to make things understandable to them.

In writing books (or papers or anything else, for that matter) there are two problems: First, most people who write books, write for an audience like themselves. Unfortunately, most people who read the book are not like the author; they have different interests, needs, and especially different experiences and educational background. Second, who writes books? Mostly people who are a little too intelligent for their own good. For most of those people, learning has been too easy. As a result they have never been forced to learn to organize information, and to communicate in a way that is clear and understandable.

In writing a readable book, it is essential to organize the information, progress logically from topic to topic, and to give a complete, unambiguous explanation of each topic, in language that any reader can follow. Few writers do this.

In contrary to the recipe to "progress logically from topic to topic", I often prefer to induce a little bit drama in the text by breaking the logical flow. So, in this moment I wonder when was it that the man who simply was born to be an engineer, realized that he was going to be an engineer.

-I never really made a conscious decision to become an electrical engineer. From the age of 14 it was obvious that I would do this.

My father was a chemical engineer, and he did all he could to encourage me in the direction of becoming an engineer, and all he could to discourage me from anything else. When I was about nine years old, he got me a kit of things to do electrical experiments: bells, lights, wire, switches, etc. I was fascinating to learn how a circuit works, how a doorbell works (a type of relaxation oscillator!) and from there I started making things out of whatever electrical parts I could find or buy. When I was 11 I discovered the radio district in Philadelphia: about six city blocks of stores selling surplus electronic parts for pennies. I thought had died and gone to heaven! I could buy an made piece of electronic equipment for a dollar or two and get hundreds resistors, capacitors, vacuum tube, and inductors. At that time (early 1960s) transistors were fairly expensive, but in the surplus district you could get them for reasonable prices. I built electronic projects from magazine like "Popular Electronics" that I read regularly.

One of the storekeepers in the radio district suggested that I get an amateur radio operator's license. It sounded interesting, and my father offered to get me a transmitter and receiver if I could get the license. When I was 12 I got my novice license, and the call sign KN3RKL. (I am still licensed as W5VHJ, but not really active any more.) After that, the die was cast. I worked up to an amateur extra class license (the highest class in the US) before I was out of high school. Interestingly, my high school was one of only two in the US that had a noncommercial FM broadcast station. I work at the station, got a first-class commercial radiotelephone license, and was able to get summer jobs as a broadcast technician while in college.

I was fortunate to grow up in the US when America was embarrassed by Russian successes and, as result, a huge effort was made to improve math and science studies in elementary and high schools. I benefited not only from the improved curriculum, but also from encouragement by teachers, family, and friends, the general idea, at that time, that science and technology were the most important subject one could study.

What is your vision of the future of our profession and if you encourage your children to become engineers?

-I never encouraged my older son to go into engineering, and I'm not working on the younger one, either. I just don't think that engineering would have been right for my older son, and for the younger one, it's too early to tell. my older son is very talented clarinettist, now a junior at the Eastman School of Music. However, he has recently developed an interest in acoustics, recording, and digital audio, so maybe he has inherited a few technology genes from me. The younger one is bookworm; I think he'll end up as a college professor in an English Literature department.

My view of the future of the engineering profession, at least in the US, is not bright, and this is frankly part of the reason I haven't encouraged my own kids to go into it. Too many companies are run by people who are motivated by greed and personal ambition, and view engineers simply as to do to achieve their goals. I regularly see situation where companies lay off all the older more expensive engineers and force the remaining young ones work 60-80 hour weeks continuously. The stress on these people and their families is terrible, but because of fear of losing their jobs, they won't resist. American companies also have been far too dependent on government and military business, which historically have been cyclic, and results in huge layoffs every fifteen years or so. Many of these people leave engineering and never return. Unless the environment is humanized and become more stable, there will be serious shortages of engineers in US industry. I see this happening already.

In Europe and Asia there seems to be much less of this type of problem. I predict that the strongest economic and technological competition in the 21. century will be between Europe and Asia, and the US, because of its self-inflicted economic injuries, will become less of an influence in the world's technology.

There are more and more women in this profession and we have already discussed that women have different way of thinking and tackle problems in a

different way. The IEEE is currently carrying out its program STAR whose aim is to popularize this profession among women. Does it mean that the problem is recognized and that we need that different way of thinking?

-It is astonishing to me that, in the US, the number of women in electrical engineering schools has not increased substantially since I was in college in the late 1960s. Engineering is a field that is, and always has been, wide open to qualified women and ethnic minorities. Nevertheless, in spite of the fact that engineering offers professional status, a good income, and minimal discrimination, feminists and women's rights advocates have not encourage young women to go into engineering. Sometimes I think that they would rather hammer against doors that are closed than walk through the ones that are open. Perhaps STAR is start in a new direction. I hope so.

Do women really approach technical problems differently from men? I don't know. One of my clients has a relatively large number of women engineers and on the whole they seem to handle technical problems the same way as men. I had the same impression of women students at UCLA and more recently at Helsinki University of Technology. The presence of women in an engineering organization is, however, a humanizing influence; without them many organizations become tiresome "old boys' clubs". When a workplace mirrors society, it is inevitably more open to unorthodox ideas, more relaxed, and less political.

Let's face it: men have not turned engineering organizations into ideal places to work. the greatest problems in engineering organizations are interpersonal, not technical. Women clearly approach these matters differently from men. Unfortunately, women often are afraid to deal with human matters in their own way, trying instead to emulate what they think would do. This is always a disaster. Perhaps if more women would enter the field, they would feel more confident in trusting their own instincts.

You were the editor of the prestigious IEEE Transaction on MTT. To what degree can an editor influence the quality of the magazine? From your point of view, what are papers the engineers write nowadays like?

The MTT Editor has remarkably little influence on the quality of the Transactions. The material available for publication is only what is submitted, and the standards are inevitably those of the reviewers. If an editor tried to enforce a set of standards that were widely different from those of the reviewers, the review process simply wouldn't work.

I'd say that about 20% of the submitted papers are dreadful, 20% are high-class publications of valid, careful, ongoing research. The world could survive admirably without the remaining 60%. Most of the latter are from academics whose main reason for submitting the paper is to "get a publication" to add to their publication lists, not fundamentally to report research results. Most of these papers are about 80% old news. It gives me the mental picture of convolution integral: shift the information axis 20% and integrate over the whole thing. Viola! A paper!

You may have noticed that I don't publish a lot. I usually keep my mouth shut until I have something useful to say. I apply this rule to committee meetings, too. I wish more people did.

Your words reminds me comments of one reviewer on the paper submitted for Transaction on MTT during my participation in Review Board. He said exactly: "I am tired of reading."

-I feel very strongly that engineers knowledge is usually too narrow, and that they should understand more of their place in the world historically, socially, environmentally, and economically. Jacob Branowski, for example, makes the point that in a technological society, technologists are the natural leaders. But how can they influence others when they don't know their own history and can't write a coherent sentence?

Here is an incomplete list of the skills I think engineers should cultivate. Most engineers don't possess these abilities, but I still think they're essential:

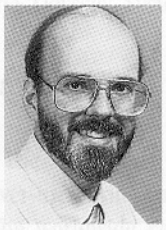
1. Communication skills are is important as technical skills. Your technical work is worthless if you can't communicate it effectively, clearly, and convincingly to others.

2. An appreciation of history, especially the history of technology, to put one's work in perspective. I regularly see people putting huge effort into work that will never be used, because it does not fit into natural historical progression of technology.

3. A basic understanding of economics. I've heard engineering described as the ability to do for one dollar what any fool can do for five dollars. That's an oversimplification, but it contains an element of truth.

4. An appreciation of the arts and literature. What we do is fundamentally no different from what artists, writers, and musicians do; only the tools and applications are different. We all create, we all solve problems.

Creativity is the ability to discover things that are not obvious; we can learn to do this from other creative people.



Steve Maas was born in Boston, Massachusetts, in 1949. He grew up near Philadelphia, and spent two years in Dusseldorf Germany while his father, a chemical engineer specializing in petroleum distillation, worked for an multinational corporation. He attended the University of Pennsylvania's Moore School of Electrical Engineering, and received BSEE and MSEE degrees. During this time, he developed an interest in radio astronomy, and eventually went to work at the National Radio Astronomy Observatory, designing the receivers for the Very Large Array radiotelescope. He subsequently moved to California, and completed PhD studies at UCLA while working for a succession of large aerospace companies. After graduation, he wrote two books–"Microwave Mixers" and "Nonlinear Microwave Circuits" and continued to work in the Los Angeles aerospace industry. In 1990 he joined the faculty of UCLA, and left it in 1992.

He is still an adjunct professor at UCLA, and now works as a consultant.

Steve Maas has been editor of the IEEE Transactions on Microwave Theory and Techniques, and won the IEEE MTT's Microwave Prize in 1989 for his work on distortion in diode mixers. He is a Fellow of the IEEE.

The interview was taken by Mrs. Branka Jokanović in winter 1996