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## Foreword to Wideband Amplifiers

Year 2001 : the year of *Clarke's/Kubrick's* Space Odyssey ; the year of HAL-9000.

Today, the Personal Computer is as ubiquitous and omnipresent as was HAL on the Discovery spaceship. And the rate of technology development and market growth in electronics industry still follows the famous Moore law, more then 3 decades after it has been first formulated (in 1965, *Gordon Moore* of Intel Corporation predicted the doubling of number of transistors on a chip every 2 years, corrected to 18 months in 1967 ; the landing on the Moon was in full preparation).

Curiously enough, today noone cares to go to the Moon again, let alone Jupiter. And, in spite of all the effort in digital engineering, we still don't have anything close to 0.1% of HAL capacity (fortunately!). While there are many research labs striving to put artificial intelligence into a computer, there are also rumors that this has already happened (with Windows-95, of course !).

In the early 1990s it was felt that digital electronics will eventually render analog systems obsolete. This never happened. Not only is the analog sector vital as ever, the job market demands are expanding in all fields, from high-speed data acquisition, telecommunications and radio-frequency-engineering, high-quality audio to grounding and shielding, electromagnetic interference suppression and low-noise printed-circuit board design, to name a few. And it looks like this demand will be going on for decades to come.

But while the proliferation of digital systems attracted a relatively high number of hardware and software engineers, analog engineers are still rare birds. So, for creative young people, who want to push the envelope, there are lots of opportunities in the analog field.

However, analog electronics did not earn its "Black Art" attribute in vain. If you have ever experienced the problems and frustrations from circuits found in too many "cook-books" and "sure-working schemes" and if you became tired of performing exorcism on every circuit you build, then it's probably the time to try it the other way: in our own experience, the HARD way of doing the correct math first often turns out to be the EASY way !

Here is a new e-book "**Wideband Amplifiers**". The book was intended to serve both as a design manual to more experienced engineers and as a good learning guide to beginners. It should help you to improve your analog design, making better and faster amplifier circuits, especially if time-domain performance is of major concern. We have strived to provide the complete math for every design stage. And, to make learning a joyful experience, we explain the derivation of important math relations from a design engineer point of view, in an intuitive and self-evident manner (a rigorous mathematician might not like our approach). We have included many practical applications, schematics, performance plots and a number of computer routines. However, as with any interesting subject, the greatest problem was not what to include, but rather what to leave out.

In the foreword of his popular book "A Brief History of Time", *Steven Hawking* wrote that his publisher warned him not to include any math, since the number of readers would be halved with each formula. So he included the  $E = m c^2$  and bravely cut half of the world population out.

We went further : there are some 220 formulae in Part 1 only ; by estimating the current world population to some  $6 \times 10^9$ , of which 0.01% are electronics engineers and assuming an average lifetime interest in the subject of, say, 30 years, if the publisher's rule holds, there ought to be one reader of our book once every :

$$2^{220} / (6 \times 10^9 \times 10^{-4} \times 30 \times 356 \times 24 \times 3600) \approx 3 \times 10^{51} \text{ seconds}$$

or something like  $6.6 \times 10^{33} \times$  the total age of the Universe !

Now, whatever you might think of it, this book is NOT about math ! It's about getting your design to run right first time ! Be warned, though, that it will be not enough just to read the book. To have any value, a theory must be put into practice. Although there is no theoretical substitute for hands-on experience, this book should help you to significantly shorten the trial-and-error phase.

We hope that, by studying this e-book thoroughly, you will find yourself at the **beginning** of a wonderful journey !

Peter Starič and Erik Margan,  
Ljubljana, June 2001

### Acknowledgments

*If I had been able to see farther than others,  
it was by standing on the shoulders of giants !*

Isaac Newton

In this "principia" of wideband amplifiers we, too, have been standing on the shoulders of giants : as ex Tektronix engineers (as well as now in other firms), they all have made monumental contributions to the electronics industry and, consequently, to the society in general. The fact that we were not shaken-off into electrons and protons also speaks of their friendly character and human dimension.

*Bob Ross, John Addis, Carl Battjes, Dennis Feucht and Bruce Hofer,*

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### Important Note !

We would like to reassure the Concerned Environmentalists that during the writing of this e-book, no animal or plant had suffered any harm whatsoever, either in direct or indirect form (excluding the authors, one computer mouse and countless computation bugs!).

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