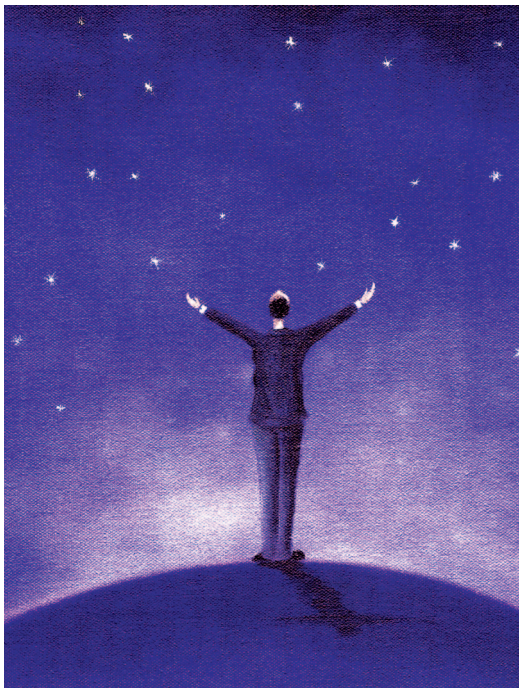
From the Editor's Desk

"All the World is a Filter," Sayeth the Bard (or Was It Seymour?)

■ Richard V. Snyder

I wrote these words in an *MTT-S Newsletter* feature article way back in the fall of 1990. This attempt at humor (I am ill advised to be humorous according to my wife) was supposed to express my feelings about the central position held by filters and passive components in pretty much everything!

Limiting myself "only" to the entire field of microwave engineering will be difficult, but in that context the Webster's definition of a filter is "a device or material for suppressing or minimizing waves or oscillations of certain frequencies." This definition is certainly accurate, but it isn't sufficient for microwave engineers. Amplifiers, switches, couplers, mixers, circulators, etc. . . . these all suppress (and enhance) waves of certain frequencies, perhaps in preferential directions. Such components are—much as far more complex systems (the power grid, for example) are—in fact, filters in which inherent physical properties are represented as smaller, constituent networks embedded within actual or virtual filter networks that, in turn, define the overall response of the device or system. As I said back in 1990, the concept of "embedding" subnetworks with well-defined port interface properties into larger systems applies not only to microwave devices but to such complex systems as bridges, power grids, water systems, and the like. Thus, my basic thesis becomes supportable.. . . the world indeed consists of filter networks. I knew the discussion couldn't be limited to just microwave engineering!



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Much has changed since those dark (but happy and halcyon) days of 1990. My desktop computer was probably a 33-MHz PC, with perhaps 5 MB of RAM, running the just-released Windows 3.0. I wasn't able to depend on very accurate circuit simulations of my designs because the models were not complete, nor did I have sufficient computer resources to perform complex analysis of entire structures. Our network analyzers were primarily scalar, with limited dynamic range. My design arsenal certainly did not include the new filter topologies such as trisection or quadruplet cascades. Development was more difficult because there was a good chance that any design would have quite of bit of time tied up in the lab, finding ways to suppress spurious resonances that were not predicted by the simulation technology available at the time. Papers were submitted in hard copy (can you believe it?). Papers were still presented using view-graph overhead projectors. Reviewers carried stacks of papers and finished TPC on the airplane on the way to the TPC meeting. (Okay, some things have stayed the same. . . but now the stacks are just files on a laptop.)

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These days, it is tempting sometimes to recall the statement made by the director of the U.S. Patent Office back in 1895: "we should simply close up shop because everything worthwhile has been invented already." Today, we have designs for circuits with almost every imaginable sort of coupling configuration; a myriad of transmission line types; the ability to predictably mix and match lumped and distributed elements; the ability to utilize multiple modes in waveguide, planar, and even lumped circuits; the ability to incorporate active devices and accurately predict performance under all kinds of environmental conditions—computer capability that sometimes makes me think *Star Trek* is behind the times! Basically, the ability to do everything, right? Wrong! As wrong as the seer of 1895. We might not know what is next, but surely the "final" frontier recedes as quickly as we approach. Just one example of what is coming down the pike: the potential represented by modern fabrication technology means that we filter and network types will have to learn how to design and build very complex and dense circuits with significant interaction between elements, and that will mean learning to synthesize mixed lumped and distributed networks of high order and to incorporate the electromagnetic interactions between the elements. We will not be able to wait weeks for solutions nor to afford "do-overs" because the designs were flawed. Networks built using quantum wells as resonators are possible (but not yet technologically practical). These present-day shortcomings give us the time to develop the theoretical underpinnings for applications yet to be facilitated by technological improvements.

We are always looking for a "few good people" and hope that you, the contemplative reader, will consider becoming a member of our clan.

This issue (and a follow-up issue later this year) will provide some wonderful articles covering the state of the art in design theory and practical implementation of filters. All of the authors are active members of MTT-8, the technical committee charged by the MTT-S ADCOM with oversight of the "Filters and Passive Components" technical area. Preparation of this issue has been a labor of love, because like the other authors, I love our discipline. We know that ours is a difficult area, and I frequently tell students that mastery will require years of effort beyond their final university degree. However, I also tell them that the work will be worthwhile, because pursuit of the receding technical frontier is a truly fun-filled daily challenge and makes getting up every day a joy. We are always looking for a "few good people" and hope that you, the contemplative reader, will consider becoming a member of our clan.