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Preface

Despite the fact that a range of limitations are beginning to appear as CMOS technology is being raised to ever higher levels of perfection, it is anticipated that silicon will be the dominant material of the semiconductor industry for at least the first half of the 21st century. The forecast for microelectronics development updated in 2008 by SIA (Semiconductor Industry Association) reaches ahead to the years 2016–2022. Unfortunately, comparison with former SIA forecasts indicates that in certain aspects they become less aggressive (that is less optimistic) with time.

While the development of silicon microelectronics in the past could be attributed mostly to the reduction of the feature size (progress in lithography), today it relies more on new material (SOI, SON, SiGe or SiC) and architecture (ultra-thin body, double-gate, multiple-gate) solutions. The combination of this trend with continuous miniaturization provides the opportunity of improving IC functionality and speed of operation.

Telecommunications and information technology are arguably the most powerful drivers behind microelectronics product development nowadays. Plenty of new applications are being created for fast analog and RF circuits, as well as for information processing ones. It is clear that with the anticipated peak $f_{\max} = 425$ GHz and $f_T = 395$ GHz to be reached by RF SiGe-base bipolar transistors in 2014, according to the 2008 update of ITRS, a lot of efforts must be put into the development of appropriate material, processing, characterization and modeling. While progress in the bipolar technology is impressive, the increase of MOSFET speed is even more so. The same issue of ITRS predicts on-chip clock of $\sim$14 GHz for 2022.

High-speed isn't, however, everything. Portable wireless products push, for obvious reasons, for low-power solutions. This trend requires new architectural solutions (e.g., channel thinning), and in consequence, new materials, such as SOI (or its possible successor SON – silicon-on-nothing), where current driveability is considerably higher than in conventional MOSFETs.

In this issue the Reader will find papers devoted to the history of semiconductors, charging effects at the interfaces between high-k dielectrics and SiO_2, the influence of fluorine on the quality of the Si-SiO_2 interface, large-signal RF modeling, as well as modeling and simulation of heterogeneous systems.

Wireless applications in challenging environments require improved modulation schemes and signal processing. One example is dealing with frequency offset and phase noise in orthogonal frequency division multiplexing (OFDM) systems. In a novel scheme the frequency offset is first estimated using an autocorrelation method, and then refined by applying an iterative phase correction by means of pilot-based Wiener filtering; the method was tested in a multipath indoor environment.

The next study devoted to radio systems included in this issue found that use of chaotic spreading sequence in a multicarrier code division multiple access system (MC-CDMA) to spread spectrum and estimate the transmission channel system significantly outperforms the Walsh-Hadamard code spreading in MC-CDMA system with respect to channel identification. The proposed scheme uses a chaotic sequence generated by a logistic map as a training signal and estimate channel parameters according to dynamics of the chaotic sequence.

Global satellite-based positioning systems enable to build new telematic systems for applications and services in many branches of economy, in particular applied to mobile objects like vehicles, called mobile telematic services. A paper include in this issue presents features of such services, with a special emphasis on services foreseen in Galileo satellite positioning system, including a necessity of complementary communications between a positioned object and related surroundings.

In the age of fast internet, core and metro networks widely employ wavelength division multiplexing (WDM) in optical fiber transmission to satisfy the growing need for bandwidth. While capacity of WDM networks is adequate, failure (e.g., a cable cut) potentially leads to enormous data and revenue loss, and protection is one of the key techniques used in "survivable" WDM networks. The study compares the performance of protection schemes such as dedicated path protection (DPP), shared path protection (SPP) and shared link protection (SLP), taking into account capacity utilization, switching time and blocking probability.

The last subject covered is different: optimization of the multi-threaded interval algorithm for the Pareto-set computation, and the possibility of applying interval methods to seek the Pareto-front of a multicriterial nonlinear problem. An efficient algorithm has been proposed and tested before, the current paper presents its optimization in order to increase the speedup of multi-threaded variant, and to extend the algorithm to compute not only the Pareto-front (in the criteria space), but also the Pareto-set (in the decision space).

We hope the Readers will find this issue of the *Journal of Telecommunications and Information Technology* useful and interesting.

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