DIGITALLY ENHANCED ANALOG AND RF INTEGRATED CIRCUITS

Contact details

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<tr>
<th>Name</th>
<th>Digitally Enhanced Analog and RF Integrated Circuits</th>
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<tr>
<td>Acronym</td>
<td>DERFAIC</td>
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<td>Logo</td>
<td><img src="image" alt="DERFAIC Logo" /></td>
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<tr>
<td>Site</td>
<td><a href="http://www.icdesign.utcluj.ro/">http://www.icdesign.utcluj.ro/</a></td>
</tr>
<tr>
<td>Address</td>
<td>26-28 G. Baritiu St, Rooms 26, B2, B3, S3.1, S3.2, Cluj-Napoca</td>
</tr>
<tr>
<td>Faculty</td>
<td>Faculty of Electronics, Telecommunications and Information Technology</td>
</tr>
<tr>
<td>Department</td>
<td>Basis of Electronics Department</td>
</tr>
<tr>
<td>Telephone</td>
<td>+40 264 401243, +40 264 402454</td>
</tr>
<tr>
<td>Fax</td>
<td>+40 264 591689</td>
</tr>
<tr>
<td>Director</td>
<td>Prof. Dr. Eng. Marina Topa</td>
</tr>
<tr>
<td>e-mail</td>
<td><a href="mailto:Marina.Topa@bel.utcluj.ro">Marina.Topa@bel.utcluj.ro</a></td>
</tr>
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Areas of expertise

- **Design of RF, Analog and Mixed–Signal Integrated Circuits**
  - Reconfigurable and programmable analog circuits
  - High performance Power Management circuitry, including Energy harvesting and conversion;
  - Digitally-intensive frequency synthesizers
  - Low-power radio transceivers
  - Analog Front-Ends for sensors
- **Circuit and Signal Theory and Applications**
  - Optimization techniques for analog and digital circuits
  - System modeling and analysis
  - Feedback theory & stability
- **Electronic circuits and systems for acoustics**
  - Optimized synthesis of acoustic equalizers
  - Analysis and improvement of the acoustic behavior of enclosures
- **Methodologies for optimized design and testing of electronic circuits and systems**
  - Robustness optimization
  - Multivariate performance analysis for application verification
- **Algorithms and techniques for compensating the effects of non-idealities inherent to analog circuits&systems**
  - Compensation of IQ mismatch in integrated radio receivers
  - Reduction and compensation of DC offsets

Team

Prof. Dr. Eng. Marina Topa, Assoc. Prof. Dr. Eng. Marius Neag, Lecturer Dr. Eng. Botond-Sandor Kirei, Lecturer Dr. Eng. Ioana Sărăcuţ, Lecturer Dr. Eng. Erwin Szopos, Assist. Dr. Raul Onet, 10 PhD and Master students

Representative projects

- “2.5D Modeling of sound propagation in rooms and improvement of room acoustical properties using digital implementations”, CNCSIS PCE-Idei, (2007-2010)
- “Design of analog blocks within the baseband of a radio transceiver for geological sensor, able to operate in harsh environments”, Consultancy Contract, 2010-2011
- “New integrated circuits and systems for power management, with applications to energy harvesting” Consultancy Contract, 2011-2012
- “Digital compensation of I/Q mismatches in wide-band radio receivers”, POSDRU Postdoc Project, 2010-2013
Significant results

The most representative publications of the past 5 years:


5. C. Contan, B. S. Kirei, M. D. Topa, "Modified NLMF Adaptation of Volterra Filters Used for Nonlinear Acoustic Echo Cancellation", in *Signal Processing, Elsevier*, vol. 93, no. 5, 2013, pp. 1152-1161


Patents:

D. Petreus, M. Neag, B. Morley – Improved MPPT control for PWM-based DC-DC converters with average current control, Republic of Ireland, 2010


Product realized for industrial beneficiaries:

1. High-Voltage LDO for automotive applications – Integrated circuit designed in custom technology, currently in mass production at Infineon Technologies Romania

2. Analog Front-End for automotive sensors - integrated circuit designed in a 0.18um technology, produced as a test-chip for Melexis Technologies NV, Belgium

3. Frequency synthesizer integrated within an UWB transceiver produced in 90nm technology, for Anacores Ltd., Castlebar, Republic of Ireland

4. Integrated transceiver for geological explorations – chip mass produced in a CMOS 0.35um technology, for Silansys Semiconductor Ltd., din Dublin, Republic of Ireland, currently used in industrial exploration of oil deposits

5. Smart solar charger for Li-Ion batteries and supercapacitors, with a novel analog-digital MPPT algorithm – demo board realized for Anacores Ltd., Castlebar, Republic of Ireland

The offer addressed to the economic environment

**Research & development**

Development of adaptive filter theory, with applications in the processing of non-stationary signals by non-linear systems

Extensions of the classical feedback theory, with applications in the stability analysis

Analysis and design of electronic systems and circuits using advanced modelling and optimization methods

Adaptive filters for signal processing and system analysis, with applications in acoustics

Electronic systems and circuits for harvesting power from un-conventional energy sources

**Consulting**

Analysis and design of analog, RF and mixed-signal integrated circuits

Analysis and design of digital systems, including FPGA and/or ASIC implementation

Top-level verification of digital systems using SystemVerilog and SystemC

Analysis and design of electro-acoustic systems – echo cancellation, reverberation control, signal separation, equalization etc.

**Training**

Design of analog, RF and mixed-signal integrated circuits using the industry-standard software package Virtuoso – Cadence: Schematic Editor, ADE, Layout Editor, Assura