Analog and Digital Signal Processing at EIAJ/HES-SO

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Main activities and research interests

- *Weak Signal Detection and Classification*
- *Nonlinear Filtering*
- *New Modulation Techniques*
- *Low- Noise Analog Front-End*
- *"One-Bit" DSP Techniques (Phase/ Frequency Detectors and Synchronizers)*
- *DSP "Multiplication-Less" Algorithms (e.g. Correlator, Averager, IIR Filters)*
- *Simplified Arithmetic Schemes*
- *Signal Analysis in Flow-Metering*
- *Pulse Response Technique Applications (i.e. Sonic and Ultra-Sonic …)*
- *Active Power Maximization in Transducer*
- *Multiple-Frequencies Locking System*
- *Parameters Adaptation in Time Evolving Processes*
- *"Hilbert Transform" Real-Time Digital Applications*

Services provided by "A/DSP - R&D" team

- *Study and realization of small prototypes (analog – digital and mixed SP)*
- *Technical assistance as well as theoretical support to development engineers*
- *Theoretical analysis and/or simulation of innovative signal processing techniques*
- *In-house short courses related to analog and/or digital signal processing (general or application oriented topics)*

Samples of student semester or diploma work

- Click-less Digital Audio Transfer Function Switching (LMS Algorithm)
- Pseudo Synchronous ″One-Bit″ Digital FSK Receiver
- Digital Phase-Frequency-Locked-Loop for driving ultra-sound transductors
- New digital frequency detector using the “One-bit” signal processing approach
- FPGA Implementation of a One-Bit based NBFM Demodulator based on the Balanced Quadri-Correlator Structure
- ″One-Bit″ Quadri-Correlator based all Digital Frequency Locked-Loop
- Multiplication-Less FPGA Implementation of a Gaussian Low-Pass Filter
- Numerically controlled Digital Notch Filter

Recent publications

- J.-P. Sandoz, “Analysis of a Wide-Band One-Bit based Frequency-Hopping Spread-Spectrum (FH/SS) Digital Receiver in Presence of Gaussian and Impulsive Noise”, *ICSPAT 95, Boston, USA*
- J.-P. Sandoz, ”Modified Early-Late Detector providing both Code Acquisition and Tracking without Switching of Mode in Frequency-Hopping Spread-Spectrum Receiver”, *ICSPAT 96, Boston, USA*
- J.-P. Sandoz, C. Zaugg, ”Code Acquisition and Tracking without switching of Mode in combined FH/DS Spread-Spectrum Communication Systems”, *Wireless 97, Calgary, Canada*
- J.-P. Sandoz, C. Donzelot, ”Real-Time Simulation of a Digital, One-Bit based, Balanced Quadri-Correlator applied to Narrow-Band FM Demodulator”, *International Workshop on Intelligent Communication Technologies and Applications, Neuchâtel, Switzerland, 1999*
- J-.P. Sandoz, C. Donzelot, “Computer Simulation of a Digital, One-Bit based, Balanced Quadri-Correlator Applied to Multi-Level FSK Demodulator”, *ICSPAT 99, Orlando, Florida, USA*
- J-.P. Sandoz, “Simplified Arithmetic Hilbert Transform based Wide-Band Real-Time Digital Frequency Estimator ”, *ISPC 03, Dallas, Texas, USA*

Jean-Paul Sandoz graduated from the Engineering College of Canton Neuchâtel and received the Master of Applied Sciences degrees in Electrical Engineering from Ottawa University, Canada.
He worked at the Observatory of Neuchâtel, Switzerland, on digital synchronous receivers, digital PLL and geophysical instrumentation. He also worked with EDA Instruments Inc., Toronto, Canada as development engineer and later, he was a member of the research staff with Sodeco-Saia, Geneva.
He is presently Professor of Analog and Digital Signal Processing at EIAJ-HES/SO, Western Switzerland University of Applied Sciences. His teaching and research interests include applied DSP techniques to weak signal detection and classification, low-noise analog front-end, “One-bit” DSP techniques with applications to Phase/Frequency Detectors, Time Delay Estimators and Multiple Pulse Response Technique. He is currently active in “Hilbert Transform” Real-Time Digital Applications. He gave several DSP seminars including one in Ujung Pandang, Indonesia.