

**Antal Soos**, PhD Electrical Engineering

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## OBJECTIVE

Research and design position that utilizes my extensive experience in Real-Time Digital Signal Processing, Embedded Systems, Control Systems and Communication Systems, including algorithm development, hardware and software design.

## SUMMARY OF QUALIFICATIONS

Over twenty years of industrial experience in Research and Development (R&D). Cross-functional role on the team, responsible for development, design and implementation of complex firmware using DSPs, FPGAs and microprocessors for sensor fusion, digital filtering, digital communications, signal and data processing algorithms.

## AREAS OF EXPERTISE

- **Real-Time Digital Signal Processing (DSP)**
  - Implemented adaptive algorithms (**RLS**, **LMS** and **Kalman Filtering**) for system identification, echo cancellation, equalization of communication channels.
  - Experienced in Software-Defined Radio System (**SDR**) Design.
  - Implemented Forward Error Correction (**FEC**) for error control in communication.
  - Utilized DSPs, and used **Matlab**, **Assembly**, **Python**, **C**, **C++**, **VHDL** language:
    - Analog Devices: ADSP-218xe, ADSP-2106x SHARC;   ◇ VisualDSP++
    - Texas Instruments: TMS320C2x, ... TMS320C67xx;   ◇ Code Composer
    - ARM: Cortex – M3, M4;   ◇ Eclipse
    - Microchip: PIC and dsPIC;   ◇ MPLAB X IDE
    - Intel Processors;   ◇ Visual Studio
    - Xilinx/Intel/Microsemi: FPGA and CPLD;   ◇ Vivado/Quartus/Libero
  - DSP target systems used: Bare Metal, DSP/BIOS, FreeRTOS, Linux and Windows.
  
- **Control Systems**
  - Designed Proportional-Integral-Differential (**PID**) controllers.
  - Implemented Linear Quadratic Gaussian Regulators (**LOGR**) and **H<sub>∞</sub>** optimal control design to stabilize high complexity dynamic systems.
  - Implemented control mechanisms for Chaotic System Stabilization.
  
- **Hardware Design and Integration**
  - Designed signal processing systems using multiple DSP on the electronic circuit board.
  - Designed data acquisition electronic circuit boards using high-speed A/D.
  - Experienced in Phase-Lock-Loop (**PLL**) design.
  - Designed fiber-optic and copper communication interfaces for T1/E1 and Ethernet.
  - Implemented high speed baseband communication Serializer/Deserializer (**SerDes**) using **HDLC** and **Manchester Encoding** algorithms in **VHDL**.
  - Developed firmware including hardware controllers (interrupts) and device drivers.
  - Utilized **FPGAs** with the **VHDL** to implement Register-Transfer-Level (**RTL**) logic on Spartan (Xilinx), Cyclone (Intel/Altera), and SmartFusion (Microsemi/Actel) devices.
  - Used isolated and non-isolated serial interfaces: **SPI**, **UART**, **CAN**, **I<sup>2</sup>C**.

## PROFESSIONAL EXPERIENCE

2014 Jun. – Present      **Digital Signal Processing Specialist and Electronics Designer**  
*Pulse Directional Technologies, Calgary, AB*

Designed and developed high temperature electronic hardware and corresponding firmware for various projects including motor drivers, communications and control systems, and precision sensors. Responsible for defining and implementing Digital Signal Processing (DSP) algorithms for use in both surface software and downhole systems.

- For the reception of the communication signal from the drill in the oil well, implemented a signal decoding algorithm in the form of a Software Defined Radio. The code was developed in Visual Studio 2015 environment. For real-time signal observation the VTK software library was used to display in multiple windows the state of the signal. The decoded data was presented in the HTML5 environment, for which a WebSocket Server and Client communication were developed, using JSON packets.
- Designed electronic hardware for pressure measurement (0-20k PSI) in the oil well during drilling, which must withstand high temperature environments up to 175°C.
- For controlling a 66W, 3100RPM 3 phase Brushless DC electric (BLDC) motor, designed a 3 phase MOSFET control board. Implemented the required control algorithm on a 16bit dsPIC from Microchip Technology. This design also supports the required high temperature functioning environment, up to 175°C.
- Designed a DC/DC power converter, 7-30V to 1500V, for use in a scintillation detector, which works in downhole environments up to 180°C.

2012 Nov. – 2014 Jun      **Research and Design** (<https://www.asoos.com/pages/projects.htm>)  
*aSoos Inc., Calgary, AB*

- Developing data transmission over battery power line (COBL), to connect multiple devices. The goal of the design is a product which is autonomous, economical, small in size, and can be utilized at extreme temperatures (150°C).
- Developed an analog interface board (A2D2A) for Texas Instruments TMS320 DSK system, which is capable of simultaneously sampling 8 analog input signals and driving 4 analog output signals, controlled by any Texas Instruments Development Starter Kit (DSK).
- Worked on WebSocket communication; developed servers and clients for real-time WebSocket data transfer.

2011 Sep. – 2012 Oct.      **Digital Signal Processor Engineer**  
*Schlumberger Ltd - Extreme Engineering, Calgary, AB*

Developed Digital Signal Processing (DSP) algorithms using C/C++ for programmable telecommunication systems to meet the unique needs of low-power electromagnetic (EM) telemetry system communications for Measurement While Drilling (MWD).

**Worked on Software-Defined Radio System (SDR) Design in C/C++:**

- Phase-Shift Keying (PSK) modulation transmitter and receiver design for Binary PSK (BPSK) and Quadrature PSK (QPSK).
- Symbol synchronization in the receiver using correlation and rotation.
- Calculation of received symbol confidence for error correction.
- Signal-to-Noise Ratio (SNR, S/N) estimation in the received signal.

- Automatic Gain Control (AGC) algorithm development using Hilbert Transformations.
- Carrier frequency (AFC) and phase (APC) estimation for coherent communications receiver design.
- Arbitrary sample rate change algorithm implementation with a combined Digital down-converter/Decimation and up-converter/Interpolation algorithms, using the cascaded integrator-comb (CIC) filter technique.

2010 Dec. – 2011 Sep.

### **Lead Hardware Designer**

2002 Apr. – 2003 Sep.

1998 Jan. - 2000 Jan.

#### ***General Electric - Power Services, Calgary, AB; Markham, ON***

- Responsible for the redesign and coordination of pre-production processes for various D20 Intelligent Peripheral Modules. *The D20 device is characterized by distributed, expandable I/O architecture* and mission-critical automation control applications. The redesign included the replacement of obsolete parts, such as the HC11 processors with FPGA based soft-core computation devices written in VHDL.
- Spearheaded the required product qualification tests, i.e., environmental, electrical, Accelerated Life Testing (ALT) and Highly Accelerated Life Testing (HALT).
- Evaluated the DSP enhancement possibilities and proposed a new design solution for the existing "D25 Substation Controller," a multifunctional intelligent electronic device which measures the power quality of transmission lines.
- Designed the DSP board of the "D25 Substation Controller," including software improvement and FPGA code development.

2010 Apr. – 2010 Dec.

### **Designer**

#### ***Interalia Inc., Calgary, AB***

Inertial Navigation system development for Light Rail Transit, to supplement GPS measurements in places with limited satellite reception. The implemented system, in C/C++, consists of a combination of the GPS measurement, along with a three axes MEMS accelerometer and gyroscope.

2007 May – 2010 Apr.

### **Staff Engineer**

#### ***ION Geophysical Corporation, Stafford, Texas, USA***

Responsible for designing a new generation of low power, battery operated VectorSeis digital sensors. The VectorSeis sensors are an essential element in the field of seismic data processing. Based on three identical highly sensitive micro-electro-mechanical accelerometer chips (MEMS), controlled by an FPGA where the local signal processing is performed, VectorSeis measures true 3D ground motion and records full seismic wave fields with unsurpassed vector fidelity.

- Developed RTL Signal processing algorithms in Delta-Sigma space using VHDL language in Cyclone III.
- Defined and introduced a chaotic system stabilization algorithm.
- Implemented a process for temperature compensation in a measured signal using the Nios II processor in Cyclone III.
- Participated in root cause of the PLL clock's jitter source. The clock is used for timing the MEMS accelerometer, in order to archive a 146 dB dynamic range (24 bits) measurements this clock required to be clean in the same order.

2007 Sep. – 2010 Apr.                   **Research Programmer**

***Rice University, Houston, Texas, USA***

Responsible for software development for XML data processing and Graphical User Interface (GUI) design using Qt development environment. Debugging C++ software which implements the Artificial Neural Networks based on Kohonen's Self-Organizing Maps (**SOM**).

2006 Feb. – 2007 Apr.                   **R&D Consultant.**

***Nortel Networks – Calgary, AB***

- Developed DSP firmware for Texas Instruments TMS320C5410A on Nortel Triton System's Global Analog Trunk Service Card.
- Designed software for testing and monitoring hardware integrity in cooperation with Flextronics Corp.
- Defined an adaptive echo cancellation algorithm for enhanced near-end echo cancellation for the connection of Nortel's products with the Public Switched Telephone Network (PSTN). Products included the Business Communications Manager 50 (BCM50), which is an all-in-one platform for converged voice and data communications.

2001 May – 2002 Feb.                   **Senior Member of Technical Staff**

***Tyco Telecommunications (US) Inc., Eatontown, New Jersey, USA***

- For "Dry Plants" the transmission, powering, and network monitoring equipment that is located at cable stations:
- Responsible for the design and implementation of DSP and maintenance processor-related firmware for transoceanic optical network line terminating and transmission equipment, using multiple Motorola 56F807 DSPs.
- Implemented high accuracy control loops for laser wavelengths and power control using PID and PWM controlled circuits with Thermo Electric Coolers (TECs), to achieve  $\pm 0.01K$  accuracy for the laser temperature.

1994 May - 1998 Jan.                   **Digital Designer**

***NovAtel Inc., Calgary, AB***

***Harris Inc., Harris Wireless Access Division, Calgary, AB***

For the cellular systems of a remote and rural telecommunications markets: Responsible for developing and implementing base-band signal processing algorithms for the North American TDMA Cellular system's base station.

- Designed DSP software using Texas Instruments DSP TMS320C54x:
  - Designed and implemented base-band processing algorithms for North American TDMA cellular air protocol according to IS-136 standard: compandor (2:1), pre-emphasis, de-emphasis, interpolations, decimation, SAT ton generation and detection.
  - Designed software for Echo cancellation and Equalization of communication channels.
- Developed digital hardware for T1/E1 primary rate communication:
  - Generated base-station clocks with PLL circuits.
  - Implemented logic circuits using CPLD and VHDL language.

## EDUCATION

2005 University of Calgary Calgary, AB. Canada

**PhD in Electrical Engineering** with specialization in Signal Processing and Control Systems:

*" $H_\infty$  Model Predictive Control - Theory and Application"*

1997 University of Calgary Calgary, AB. Canada

**MSc in Electrical Engineering** with specialization in Control Systems:

*"An Optimal Adaptive Power System Stabilizer"*

1986 University of Novi Sad Novi Sad, Serbia

**Dipl. Ing. (Bsc; five year program) in Electrical Engineering** – Measurements and Control Systems: *"Developing Control via Hydraulic Robotics"*