

# Val DiEuliis, Ph.D.

Electronics Consultants  
1033 Fairmount Avenue  
St. Paul, MN 55105

[651] 297-8674  
valdieuliis@electronicsconsultants.com  
www.electronicsconsultants.com

I am an electrical engineer with over 40 years of experience in the electronics industry. As an independent consultant since 1984, I have served a diverse clientele having equally diverse needs. I have worked for large corporations, small companies, startup companies, and individual entrepreneurs. I have managed projects, studied product and system feasibility, assessed technology, advised executive management, mentored young engineers, and provided litigation support to attorneys and their clients. I have developed products, systems, and devices for industrial, consumer, commercial, military, and medical applications. I have performed research and development in corporate and academic laboratories, and worked with testing, sustaining engineering, and manufacturing organizations. I have also taught graduate and undergraduate courses in electronics, computer networks, and control theory.

I have developed software, firmware, and electronic hardware including analog circuits, digital circuits, and electronic microcontroller-based devices, for a variety of applications, including light detection, sensing industrial valve position using magneto-resistive devices, diagnosing under-the-hood automotive sensors, detecting phosphorescence, measuring the height of river water, charging batteries for an orthopedic tool, and testing furnace igniters. I've designed servo systems, data detectors, signal processors, and test systems for magnetic disk and CD, DVD, Magneto-Optical (MO), and WORM optical disc technologies, and I've designed computer peripheral devices for PC, EISA, VME, and proprietary data busses. I have evaluated product design and performance and have characterized electronic and electro-mechanical components for performance and failure. The table below highlights many of the skills and areas of expertise that I've applied to these projects.

## EXPERTISE

- |  |   |
|--|---|
| ▪ Algorithms                                       | ▪ Magnetics                                   |
| ▪ Analog Circuit Design                            | ▪ Mathematical Modeling                       |
| ▪ Assembly Language                                | ▪ MATLAB and Simulink                         |
| ▪ C/C++, Java, Visual Basic, HTML, Pascal, Fortran | ▪ Microcontroller Development                 |
| ▪ Computer System Peripheral Design                | ▪ Optical Detection                           |
| ▪ Control Systems                                  | ▪ Optical Disk Technology (CD, DVD, MO, WORM) |
| ▪ Data Acquisition                                 | ▪ Product Development                         |
| ▪ Data Communications                              | ▪ Project Management                          |
| ▪ Data Storage                                     | ▪ Requirements and Specifications             |
| ▪ Digital Circuit Design                           | ▪ Sensors                                     |
| ▪ Digital Signal Processing (DSP)                  | ▪ Servo Systems                               |
| ▪ Electro-Mechanical Devices                       | ▪ Software/Firmware Development               |
| ▪ Embedded Systems                                 | ▪ SPICE Simulation                            |
| ▪ FPGA Development                                 | ▪ System Design                               |
| ▪ Instruments and Measurements                     | ▪ Technology Assessment                       |
| ▪ Laser Optics                                     | ▪ VHDL and Verilog                            |
| ▪ Low-Power Electronics Design                     | ▪ Website Development                         |
| ▪ Magnetic Disk Technology                         | ▪ Wide Band Circuit Design                    |

## EMPLOYMENT HISTORY

1984–Present

### Electronics Consultants

Owner/Consultant

For descriptions of selected consulting projects, see **Consulting Projects** below. A partial, representative list of clients is provided in the following:

|   |                                   |
|---|-----------------------------------|
| 3M  | Nelson Bumgardner Casto           |
| Carter, Scholer, Arnett, Hamada & Mockler | Nintendo                          |
| Convolve, Inc.                            | O'Melveny & Myers                 |
| Greenberg Traurig                         | Panasonic                         |
| Honeywell                                 | Quinn Emanuel Urquhart & Sullivan |
| Imation Corporation                       | Robins, Kaplan, Miller & Ciresi   |
| Kenyon & Kenyon                           | Samsung                           |
| Lenovo                                    | Seagate Technology                |
| LG Electronics                            | Smith, Gambrell & Russell         |
| Karbon Arms                               | Toshiba                           |
| McDermott Will & Emery                    | Uniloc                            |
| McKool Smith                              | Weil Gotshal & Manges             |
| MediaTek                                  | Wilson Sonsini Goodrich & Rosati  |

1989–2001

### University of Saint Thomas

Adjunct Instructor

Developed and taught a course on computer networks.

Developed and presented a lecture on classical linear control theory.

Taught an undergraduate analog and digital electronics course comprising lecture and laboratory.

1979–1984

### 3M

Research Specialist

#### Optical Disk Technology

- Developed a digital audio recording and playback system for use with WORM (write-once-read-many) optical disks. I designed the analog front-end circuitry, the phase-locked loop timing recovery circuit, the modulation/demodulation circuitry, and the error correcting encoding and decoding logic.
- Developed servo systems for focusing and tracking an optical disk on an experimental recording and playback system. I characterized the sensors and actuators, performed theoretical modeling of the system, and designed the compensation for stabilizing the servos.

#### Magnetic Disk Drive Development and Manufacturing

- Characterized the servo signals, modeled the positioning actuator, designed the compensation, and refined the electronic circuitry for the positioning servo in an 8" Winchester disk drive product.
- Characterized and designed portions of the read channel for the disk drive.
- Solved problems in the manufacturing plant, developed assembly and test procedures, and created manufacturing documentation.

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## Digital Document Storage Technology

- Surveyed a large insurance company's operations, wrote the functional specification, and designed the architecture for a digital document capture, storage, and retrieval system.
- Designed and developed the main processor board with a Motorola 68000 microprocessor. This design, which incorporated programmable logic, included a dual-access, time-multiplexed RAM buffer memory.
- Designed and developed a peripheral board that interfaced to a computer-output-microfiche (COM) machine.

1972–1974

## U.S. Army

Specialist 4

I was an electrical engineer while stationed at an Army Security Agency maintenance depot. I performed RF measurements on radio frequency receiving systems, assessed systems and instrumentation, and designed an on-line antenna integrity test system for a field operations site.

## CONSULTING PROJECTS

2003–Present

## Litigation Support

I have provided litigation support services to attorneys and their clients:

- Testified in patent infringement cases concerning CD and DVD optical disk technology, software and algorithms, two-dimensional bar codes and systems, vibrating conveyor systems, CMOS integrated circuits, hard disk drive technology, wireless medical sensors, portable entertainment devices, and stun guns.
- Testified in depositions, International Trade Commission hearings, a jury trial, a Markman hearing, and a hearing concerning an injunction resulting from a patent litigation.
- Analyzed analog and digital circuits and systems.
- Analyzed microprocessor and digital signal processor source code, Verilog source code, controller chip specifications, and products.
- Analyzed hardware and software source code for servo control systems, microprocessor and microcontroller-based devices, image analysis, and mathematical algorithms
- Produced expert reports, declarations, and witness statements.
- Performed infringement and validity analyses.
- Consulted on prior art, patent validity and infringement contentions, and claim construction.
- Developed a technology tutorial and presented it in court.

2006–Present

## Patent Analysis

I have reviewed and analyzed patents for their technical and investment value:

- Analog and digital circuits and systems
- Data storage devices
- Magnetic and optical storage technology, systems, and devices
- Control systems
- Electronic devices

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- 2009-2014      **Website Development**  
An architect hired me to create two websites for his nationwide training courses for architects seeking LEED accreditation and training in managing an architecture practice. I designed, developed, and published his sites, which includes course and biographical information, upcoming dates and locations, and an ecommerce page for prospective buyers.
- 2012      **Component Characterization – An Inductor for a Wireless Battery Charger**  
A new company with a novel product for human vision correction asked me to test and characterize a component used to pick up the magnetic field in its non-contact battery charger circuit. The contract manufacturer of the electronics did not specify the component and a second source for it could be found. I tested the part (an inductor), created a SPICE model for it based on my test data, and identified its type, size, shape, wire gauge, and wire material based my microscope inspection. I delivered a detailed report that specified the component so that it may be purchased from multiple vendors.
- 2010      **Integrated Circuit Replacement for a Medical Device**  
A medical device company manufactures two printed circuit boards that incorporate two components—an FPGA and a Flash memory chip—that have been discontinued by their suppliers. I was hired to upgrade these printed circuit boards to replace the obsolete components. I identified pin-for-pin replacements for each part, purchased the parts, produced the FPGA's programming information, and updated my client's documentation.
- 2010      **Design Review for an Automatic Fragrance Dispenser**  
A home products company hired me to analyze a prototype battery-powered automated fragrance dispenser for compliance with safety requirements. Specifically, my client wanted to know whether a fuse was required in their circuit. I analyzed the UL 283 specification with respect to my client's product, tested the prototype for heat dissipation, and determined the design required no fuse and appears to be compliant with UL requirements.
- 2008-2009      **Programmable Precision Current Source**  
A company that manufactures industrial control valves hired me to develop a special purpose instrument—a precision programmable current source—for use in testing valve positioners in its manufacturing process. This is a handheld device with a custom user interface panel with an LED display and user pushbuttons for current selection.
- Designed a PIC microcontroller circuit and developed the printed circuit board
  - Designed and developed the user interface panel and the packaging (enclosure)
  - Designed and developed the microcontroller firmware
- 2008      **Helicopter Camera Mount Controls**  
A company that develops and installs customized modifications to helicopters and other vehicles hired me to design a control system for a retractable mast that supports an infrared surveillance FLIR camera for a helicopter.
- Identified MIL-SPEC relays suitable for aviation
  - Designed a dual-redundant control system with cockpit indicators and control switches.

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2006–2007

## **Circuit Failure Analysis**

An engineer hired me to analyze a circuit failure that had occurred by the thousands in a new product.

- Analyzed the design of the circuit
- Inspected and tested several failed circuit boards
- Researched power resistor failures
- Produced a report of my findings and opinions concerning the failure

2000–2002

## **Detector of Phosphorescent Emissions**

A materials scientist at a large company hired me to design an electronic device to detect and identify phosphorescent materials.

- Developed a MATLAB mathematical model of the illumination, phosphorescent emission, and photodetector.
- Designed and developed the hardware and firmware for a small, battery-powered PIC microcontroller-based detector of the phosphorescent materials. This detector included a bright LED illuminator and a super-high gain, low noise photo-detector circuit. The electronics fit into a slim, hand-held package that easily fit into a shirt pocket or a small purse.
- Researched and developed advanced algorithms for identifying the phosphorescent materials.

1998–2002

## **Sky-Ride at the Minnesota State Fairgrounds**

The owner of the Sky-Ride cable car at the Minnesota State Fairgrounds hired me to design and install controls, work with safety inspectors, and improve his maintenance procedures.

1997–2001

## **Industrial Valve Position Sensor**

A manufacturer of industrial control valves hired me to develop the electronics for a rotary position sensor and a HART modem.

- Co-developed the concept of a position sensor using two magneto-resistive sensor chips and a microcontroller, and evaluated its feasibility.
- Developed a mathematical model using Visual Basic to aid in selecting design parameters such as magnet size, magnet spacing, and analog-to-digital converter resolution.
- Developed an automated prototype tester to aid in the design and manufacture of the device.
- Designed and tested the analog front-end and signal conditioning circuitry for the production units, and developed a hybrid circuit board for the magneto-resistive sensor chips.
- Wrote key sections of the C language sensor software to incorporate efficient straight-line code in critical areas and a table lookup of the position result.
- Designed, developed, and manufactured a modem for the HART (Highway Addressable Remote Transducer) communications network, which is a 1200 Baud FSK link on a 4-20 mA current loop circuit.
- Researched and tested communication transformers, and designed a transformer-coupled interface to the HART circuitry that met the HART specification's terminal impedance requirements.

1998–2000

## **Servo for a Magnetic Head Tester**

A magnetic disk drive manufacturer hired me to develop a head-positioning servo for the company's production head test systems.

- Developed requirements and specifications, designed the architecture, and identified the major components for the servo system.
- Developed the hardware, including a servo position demodulator, analog front-end circuitry, and digital logic using VHDL descriptions for Xilinx field-programmable gate arrays (FPGA).
- Created and implemented algorithms for tracking the servo header information across the surface of the disk.
- Analyzed disk surface testing results to demonstrate how the new servo improved the magnetic head test when compared to prior tester systems.
- Characterized and modeled system components and control algorithms using MATLAB and SimuLink.

1999

## **Power Inverter PCB Reverse Engineering**

A manufacturer of power inverters hired me to create a schematic and bill of materials of an existing circuit board.

1998

## **Book Demagnetizer Design**

A large company that developed products for libraries hired me to perform a preliminary design study for a device that would automatically scan a magnet to demagnetize the security strip in a book before a patron left the library. I developed an aluminum structure that met the weight and strength requirements, and identified an inexpensive, small stepping motor to move the magnet.

1997

## **Condition-Based Maintenance System**

A large company's research center hired me to develop the functional requirements for a condition-based maintenance (CBM) system to predict failure probabilities for large motors, gearboxes, and other equipment on U. S. Navy ships. I analyzed the original proposal to the Navy, worked with the project team to develop a set of requirements, and designed a system architecture based on the requirements.

1992–1997

## **Optical Disk Technology**

A division of a large company hired me to develop a tester for a new generation of rewritable magneto-optical (MO) disks.

- Developed the laser optics, mechanics, focus and tracking servos, optical signal detection, instrumentation, and software for a MO disk test system.
- Created and automated test procedures to evaluate media performance, tested disks, analyzed test data, and presented the results to my client's management and their OEM customers.
- Designed and built an optical and electronic module for High Density CD disks, a precursor to DVD disks.
- Tested both optical disks and a recording system designed for flying-head near-field MO recording and playback.

1996

**Avionics Environmental Monitor**

A large company's research center hired me to design and build an electronic device to monitor the shock, vibration, and temperature in a compartment of an avionics bay in a U. S. Air Force B-1 bomber.

- Designed and developed a low power circuit board to collect the data and transfer it to the memory on a commercial-off-the-shelf (COTS) processor. The device included a 3-axis accelerometer, temperature sensors, and a PIC microcontroller.
- Created a packaging scheme that met the customer's detailed volume and shape requirements.
- Wrote the firmware that collects, analyzes, and stores the data; and interfaces with the user through a RS232 port.

1992

**Radio Frequency Billboard Network**

A national billboard company hired me to investigate the technology of a startup company that had developed a system to monitor the lighting on billboards and report the status to a central office using a wireless network.

- Visited the company, analyzed its prototype hardware and software, and estimated the cost of manufacturing and operating the system.
- Wrote a report that described the technology, estimated the amount of work and money required to implement it, and explained the administrative tasks required to operate and maintain a national billboard network.

1991–1992

**Instrument for Automobile Engine Sensors**

An entrepreneur hired me to develop a handheld tester to measure the outputs of the temperature, throttle, and manifold sensors in an automobile's engine compartment.

- Designed the hardware, built a prototype, and wrote the firmware for a battery-powered, handheld device that included a microcontroller to acquire the sensor signals, convert them into digital form, store them, and display the results on a liquid crystal display (LCD).
- Developed a custom membrane switch for the front-panel user interface.

1990–1992

**EISA-VME Bus Interface**

A developer of computer bus interfaces hired me to develop a transparent interface between the EISA bus and the VME bus.

- Designed an EISA bus board, which supported bus master, DMA, and interrupt operations, and incorporated a variety of logic types, including PALS and Xilinx field-programmable gate arrays (FPGAs).
- Debugged the first printed circuit boards and integrated them into my client's hardware and software system.

1985–1990

**Troubleshooting and Consulting for Manufacturing Plants**

A manufacturer of bar code systems hired me to solve his customers' data communications problems.

- Found a difference in the neutral voltages between two computers prevented the proper operation of an RS422 communications link; solved the problem by installing transformer-coupled modems on each end of the connection.
- Determined that low-quality cable was the source of excessive data errors on several communications links; solved the problem by installing an appropriate cable.
- Determined a printer malfunction was caused by a floating neutral line in the plant's power transformers; solved the problem by connecting the floating neutral line.
- Found design flaws in a bar code reader that led to failures in installations with noisy and low-voltage power lines.

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1988–1989

### VME board with the SEAP Interface for a Color Workstation

A digital imaging engineering group hired me to develop a VME board to connect a color image workstation to a high quality image digitizer through a German interface called SEAP.

- Studied the German SEAP specification, wrote a detailed hardware and software specification of the circuit board, and reviewed it with my clients and an engineer in Germany.
- Designed the VME side of the circuitry with DMA, bus master, and interrupt capabilities, and designed the SEAP side with a finite state machine controller, register programmable parameters, and bit and byte swapping.
- Built and debugged the prototypes.

1987–1989

### Battery Charger for a Surgical Tool

An organization that specialized in products for orthopedic surgery hired me to develop the electronics for a surgical tool.

- Designed and built a test instrument that discharged experimental Ag-Zn batteries at 25 Amperes.
- Designed, developed, and manufactured the electronics for a battery charger, and integrated it into my client's manufacturing plant.
- Wrote a detailed test specification and developed a functional tester for the charger.

1986–1987

### ISA Board and Software Driver for Industrial Control

A manufacturer of bar code systems hired me to develop a computer peripheral board that would allow factories to schedule the operation of various devices—such as buzzers, lights, and locks—in advance, for up to one year.

- Designed and manufactured a peripheral board for the IBM-AT computer. This design included an accurate real-time clock circuit with battery-backup, and relay, analog comparator, and digital logic input/output circuits.
- Wrote the software for the system, including a memory resident program that operated in the background of the DOS operating system.

1986–1987

### Furnace Igniter Tester

A manufacturer of furnace controls hired me to develop a device that tests electronic furnace igniters and provides a GO/NO\_GO result. I developed the hardware and firmware for a microcontroller-based device that controlled the test sequence, activated relays and other circuits, and presented the result.

1985–1986

### Wireless Bar Code System for Hospitals

The founder of a startup company hired me to provide technical direction for his company as it developed a hospital-wide, wireless, bar code system for patients and medications. The project took place on two fronts: the development of a database and computer network, and the development of a portable, wireless bar code reader.

- Interviewed hospital personnel, wrote a description of hospital operations, and wrote the functional specification for the software developers.
- Managed the software project through the prototype stage.
- Managed all aspects of the technical development, including meeting with prospective vendors, wireless developers, industrial designers, and model-makers; and consulting with the developers of the bar code reader's specifications, hardware, and firmware.



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## 1985–1986 Printed Circuit Board Inspection System

A company that was developing an automated inspection system for printed circuit boards hired me to develop two VME boards and a gate array test system.

- Designed a VME board that supported interrupt, bus master, and DMA operations and interfaced the main VME processor to an array of gate arrays.
- Designed a digital input/output (I/O) VME board.
- Developed a system to test gate arrays.

## 1984–1985 ISA Board for 4-Port RS422 Serial Communications Multiplexer

A manufacturer of bar code systems for manufacturing plants hired me to develop a peripheral board for the IBM-PC to replace an external 4-port RS422 communications multiplexer. I developed the prototype and manufactured the product.

## 1984–1985 Ultra-Sonic System for Measuring River Height

A company that developed weather data collection and display systems hired me to develop a system to monitor the water level in rivers.

- Developed the analog driver and receiver circuitry for an ultrasonic transducer and a battery-powered microprocessor system to measure changes in water height. Also designed a rugged packaging scheme for outdoor installation.
- Wrote the real-time firmware to drive the ultrasonic transducer, synchronize the reception of the echo signals, store the echoes, and analyze them using statistical correlation techniques. The firmware also operated the LED displays, a keypad, a RS232 port, and a modem.

## EDUCATION

|      |  |                               |
|------|--|-------------------------------|
| 1978 | University of Illinois at Urbana-Champaign | Ph.D., Electrical Engineering |
| 1976 | University of Illinois at Urbana-Champaign | M.S., Electrical Engineering  |
| 1972 | University of Notre Dame                   | B.S., Electrical Engineering  |

## PATENTS

| <u>Number</u> | <u>Issued</u> | <u>Title</u>                                 |
|---------------|---------------|--|
| 6,484,751     | 11/26/2002    | Position Detection for Rotary Control Valves |
| 6,244,296     | 06/12/2001    | Position Detection for Rotary Control Valves |

## PUBLICATIONS

DiEuliis, Val Anthony, *Synthesis of Ternary Codes for Spectrum Shaping*, Coordinated Science Laboratory R-733, July 1976, University of Illinois-Urbana, Illinois UILU ENG 76-2221. (Master's Thesis)

V. A. DiEuliis and F. P. Preparata, "Spectrum Shaping with Alphabetic Codes with Finite Autocorrelation Sequence," *IEEE Transactions on Communications*, Vol. COM-26, No. 4, April 1978, pp. 474-478.

DiEuliis, Val, *An Efficient Algorithm for the Spectra of Block Coded PAM Signals*, Coordinated Science Laboratory Report R-771, June 1977, University of Illinois-Urbana, Illinois UILU ENG 77-2218.

DiEuliis, Val Anthony, *Coding for the Control of Intersymbol Interference in Baseband Channels*, Coordinated Science Laboratory Report R-830, December 1978, University of Illinois-Urbana, Illinois UILU ENG 78-2223. (Doctoral Dissertation)

**PROFESSIONAL ASSOCIATIONS**

Life Senior Member, Institute of Electrical and Electronic Engineers (IEEE)  
Registered Professional Engineer in the State of Minnesota (PE, Electrical, #15546)