

# Cutting-Edge Engineered Solutions

ESL's R&D Engineering Services Group is significantly involved in Electromagnetic Aircraft Launch Systems (EMALS), hybrid electric vehicles and precision instrumentation.

ESL offers expertise in embedded controls, sensorless motor controls, multi-level inverters, controls modeling and simulation for motor drive systems, energy storage and energy harvesting. ESL employs many types of DSP/microcontrollers to implement controls.

ESL has designed structural controls to reduce bending or vibrations, PI controllers, advanced LQG, H-infinity controllers, sliding mode controllers and much more.

ESL designs precision instrumentation products involving strain gage and LVDT sensors, MIL spec cables and high-density fiber optics.

## Research and Development Projects

### Servo Motor Applications

Adaptive and Sensorless Control

### Linear Motor Applications

Aircraft Launch/Arrest

Maglev

### Switched Reluctance Motor Research

Reduced Noise

Sensorless Control

### Power Electronics

Multilevel Inverters

### Robotic Applications

Robot Joints

### Structural Control

Resonance Mitigation

### Smart Sensors

Integrated Transducer Digitization

### Ocean Energy Extraction

Ocean Wave Energy Harvesting

### Automotive/Vehicle Applications

Starter/Generators

Active Suspension

Electric Propulsion

HEV Traction Drives

SRM Power Steering and Electric Pumps

Intelligent Battery Charging

Fault Resilient Control

### Distributed Control

Closed Loop with Networked Sensors/Actuators

### Wireless Web-Based Monitoring and Control

In-Vehicle Data Acquisition with Streaming Web Data

### Web-Enabled Systems

Web-Based Experimentation



**Electro Standards Laboratories**

ADVANCED SYSTEMS DESIGN & SERVICES



### Research & Development

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## Core Capabilities

### Advanced Electric Motor Control Algorithms

- High performance servo control of AC machines including adaptive control for changing environments and parameter estimation for motor diagnostics and prognostics.
- Fault resilient controls for systems in demanding environments that must continue to operate in the event of sensor failures.

### Sensorless Control of AC Motors

- Development and implementation of mechanically sensorless control to allow high-fidelity control of AC machines in the absence of position sensors.

### Power Electronics Systems

- Control algorithms for operation of multilevel inverters for low noise and high power applications.
- Power management for hybrid electric and battery management.

### Data Communications and Switching Systems

- Remote IP switching systems for data routing from remote locations.
- Secure and ruggedized switch systems for high-security applications.
- Gigabit Ethernet switches and converters

### Fiber Optic Communications

- Fiber optic switches, converters, and high density cable assemblies.
- Very high speed ruggedized Fiber to RS485/422/232 Interface Converters.

### Digital Signal Processor Based Boards for Custom Solutions

- Design and development of digital signal processor based electronics suitable to implement high performance control algorithms in industrial, commercial or defense environments

### Computer Simulation for Dynamic Control/Estimation Systems

- Computer models of appropriate fidelity to assist in the development and testing of control, estimation, and communications systems.

### Web-Based Real-Time Monitoring and Control with GPS

- Remote monitoring and tracking with embedded sensors from anywhere in the world using the Internet

### Precision Instrumentation for Sensors and Control

- Miniaturized precision electronics and signal processing for distributed smart sensors.
- Precision electronics measurement and control systems.

### Embedded and Graphical User Interface Software.

### Manufacturing of Prototypes and Full Production Products.

### Design and Installation of Computer Networks.

## R&D Contract Engineering Services

**ESL R&D Engineering Services Group** leverages years of practical experience with the latest in classical, adaptive, and intelligent control technologies to provide innovative, timely and cost-effective deliverables. From theoretical development and modeling, to system architecture and algorithm development, to practical implementation and prototyping, ESL provides complete solutions to challenging problems.

### Electric Motor and Power Systems

ESL Provides state-of-the-art research and applied experience in AC, DC and SRM electric motor controls, estimation, and power electronics. These include mechanically sensorless motor control, hybrid electric vehicles, low noise motor control, and linear motor aircraft launch and arrest systems.

### Computer Modeling

Development of dynamic computer models, simulations and algorithms, along with experimental validation of simulation results in order to verify the predicted system's behavior.

### Fault Resilient Control for Mission Critical Applications

High performance self-reorganizing controllers for electric motors that automatically compensate for loss and recovery of sensors while continuing to operate at maximum performance.

### Electric Motor Efficiency and Diagnostics

State space estimation techniques such as Kalman filtering and intelligent system techniques such as fuzzy logic are employed to determine and regulate electric motor or electric generator efficiency. The same techniques also help to detect and predict impending faults.

### Remote Monitoring and Smart Sensors

Embedded electronics with real-time streaming data to remote locations via the Internet. This allows for the creation of smart sensors and smart sensor networks with GPS suitable for tracking, monitoring and controlling distributed resources.

### Motion Control, Adaptive Control, and Estimation

Applications include vibration attenuation and structural control, multi-input/multi-output systems, nonlinear control, Linear Quadratic Gaussian and H-infinity optimal control, fuzzy systems, self-tuning regulators, and sliding mode control.