



TRIDENT TECHLABS LIMITED

Empowering Technology



TECHLABS empower engineering solutions

We collaborate with you to support & develop leading-edge devices

Join us to meet your broader business goals.....

Vision and Business Goals

Our commitment to innovation is evident through our in-house engineering team's dedication and our global alliances of over two decades with leading software solution providers in the areas of electronic design automation, multibody dynamics simulation, engineering design services, virtual prototyping & manufacturing, automation, AI/ML, power system solutions and power consultancy services. We have harnessed this commitment to continuously drive success in the industry, offering cutting-edge solutions to meet our clients' ever-evolving needs.

Techlabs is committed towards working in a cohesive model of collaboration and partnership with our esteemed customers to achieve success mutually for the overall growth of the organization and partner eco-system. Techlabs believes in conducting business in an ethical and responsible manner aimed towards success for all the stakeholders.

Our revenue growth has aligned with market trends, reflecting significant progress and strong performance.



Sukesh Naithani
CEO & CFO

Techlabs has put their intelligence to work at every step of their journey to align its limited resources with needs of its customers and prepare itself in time to address the market when it moves to the next generation of growing technology.



Techlabs At a Glance

With over 25 years of excellence, Trident Techlabs stands at the forefront of delivering innovative technology solutions that empower businesses to excel in a competitive global market. Headquartered in New Delhi with branches in Pune, Bangalore, Chennai, Hyderabad, Kolkata, and an international subsidiary in Dubai, we combine deep domain expertise with a commitment to quality as an ISO 27001:2022 and ISO 9001:2015 certified organization, serving clients across India, the Middle East, Asia Pacific, and North America.

Our capabilities span four core verticals—Power System Solutions, Engineering Solutions, Cybersecurity, and Semiconductor—each designed to drive performance, efficiency, and innovation, ensuring our clients gain a competitive edge in their respective industries.

POWER SYSTEM SOLUTIONS

Delivering end-to-end expertise in electrical power system planning, analysis, and optimization. From load flow studies to safety assessments, our solutions ensure reliable, efficient, and future-ready power distribution networks for utilities and industries worldwide.

ENGINEERING SOLUTIONS

Empowering innovation with advanced design tools, simulation software, and product development support. We partner with global technology leaders to provide cutting-edge solutions that accelerate engineering excellence across diverse industries.

CYBERSECURITY

Securing your digital infrastructure with comprehensive security services, including vulnerability assessments, compliance monitoring, and end-to-end protection for networks, applications, and endpoints—ensuring resilience in an evolving threat landscape.

SEMICONDUCTOR

Driving advancements in semiconductor design and services through our dedicated subsidiary, Techlabs Semiconductor Private Limited. We offer high-performance ASIC design, verification, and implementation services, enabling next-gen electronics innovation.



Electronic Design and Automation: Verification and Validation

Making DO-254 Easier

Siemens EDA helps you meet DO-254 objectives. We offer the industry's most comprehensive platform of DO-254 development tools, training and consultation, along with the partnerships and integrations you need for your flows.

Questa® Verification Solution

The questa® verification solution transforms verification, dramatically increasing verification productivity and managing resources more efficiently built on several powerful technologies.

Questa® Formal Verification Apps

Questa® formal apps statically analyze a design's behavior with respect to a given set of properties; then exhaustively explore all possible input sequences in a breadth-first search manner. This uncovers design errors that would otherwise be missed or are impractical to find with simulation-based methods.

Questa Verification IP

Questa VIP integrates seamlessly into advanced verification environments, including testbenches built using UVM, verilog, VHDL, and systemC.

Design for Test Solutions (DFT)

The tesseract test solutions product suite provides comprehensive silicon test and operations applications and IP that addresses the challenges of manufacturing test, debug, and yield ramp for today's most complex SoCs.

Physical Verification

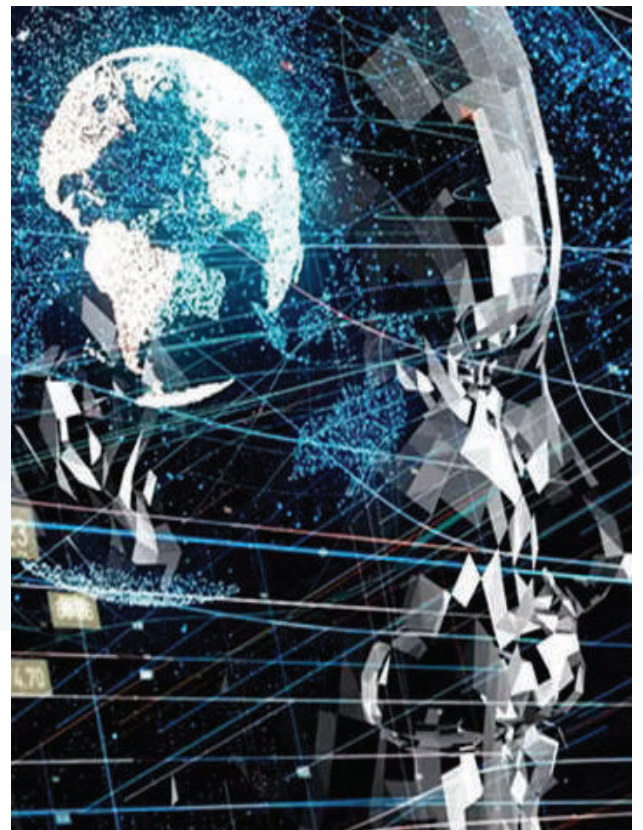
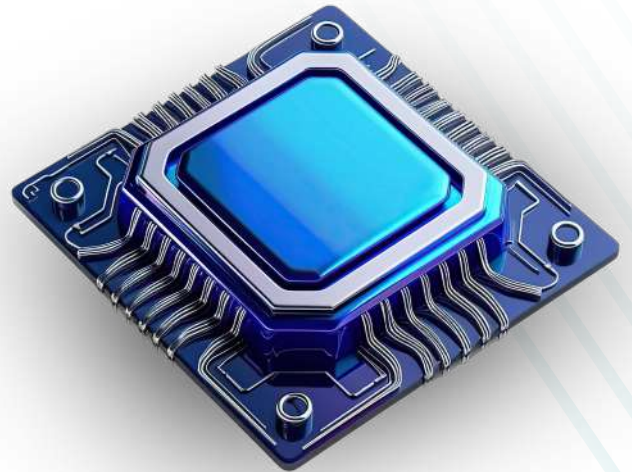
The calibre physical verification nmPlatform provides foundries, IDMs, and fabless companies with a comprehensive and innovative suite of functionality that addresses their physical verification needs from established nodes to the most advanced processes.

Hardware Assisted Verification

Siemens is a leading provider hardware assisted verification platforms and solutions delivering emulation, enterprise prototyping and software prototyping for customers to implement their shift-left strategy and accelerate SoC, software and system design and verification.

Veloce FPGA Prototyping

The veloce FPGA prototyping solution system architecture offers best-in-class modularity, scalability, flexibility, and portability to serve the verification requirements of today's hardware and software engineers.



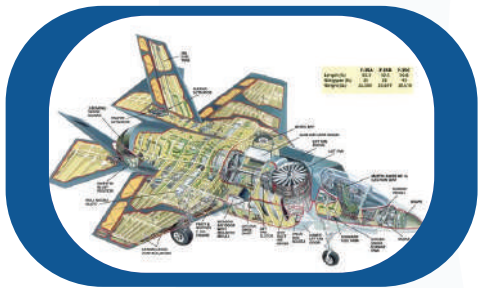
Veloce® Strato™ Platform

The veloce® strato™ platform is engineered to scale to support billion gate designs and establishes a roadmap into the next decade capable of verifying the largest chips ever designed. It delivers fast compiles, deterministic runs with full visibility and advanced debug capabilities. Shift-left and accelerate your performance, power, and functions.

PCB Design and Analysis

PADS professional premium delivers everything you need to design your simplest to most complex PCB designs. Full function, yet easy to use, with features and technologies like:

- ▶ Routing automation
- ▶ Rigid-flex
- ▶ RF design
- ▶ Analog/mixed-signal simulation
- ▶ Signal integrity analysis

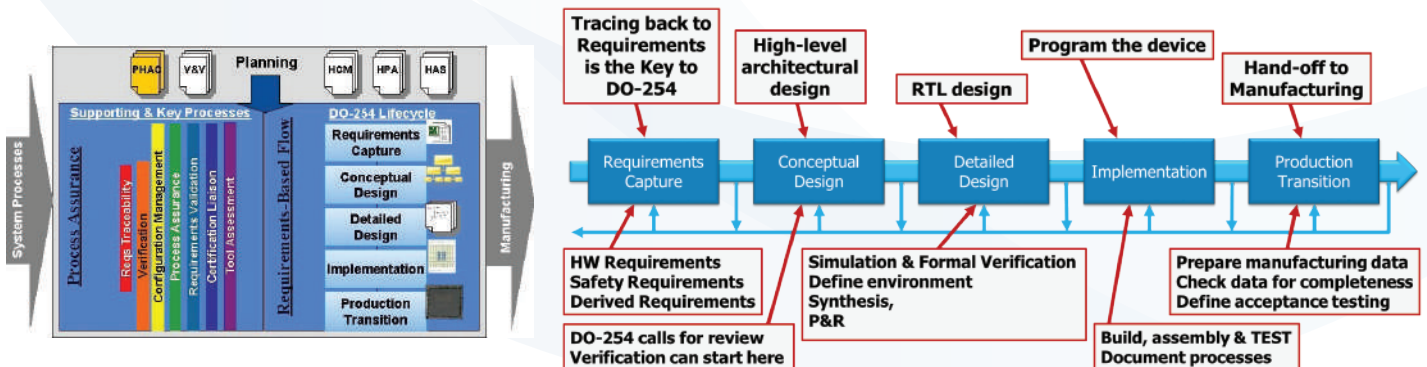


- ▶ DO-254 process
- ▶ V&V FPGA/ASIC / SOC
- ▶ PCB Design and Analysis
- ▶ DFT
- ▶ Emulation FPGA / ASIC
- ▶ CAM Manufacturing
- ▶ Physical Verification
- ▶ Verification IP
- ▶ IC Design
- ▶ IC Physical Design
- ▶ Hardware Prototyping
- ▶ IC Packaging

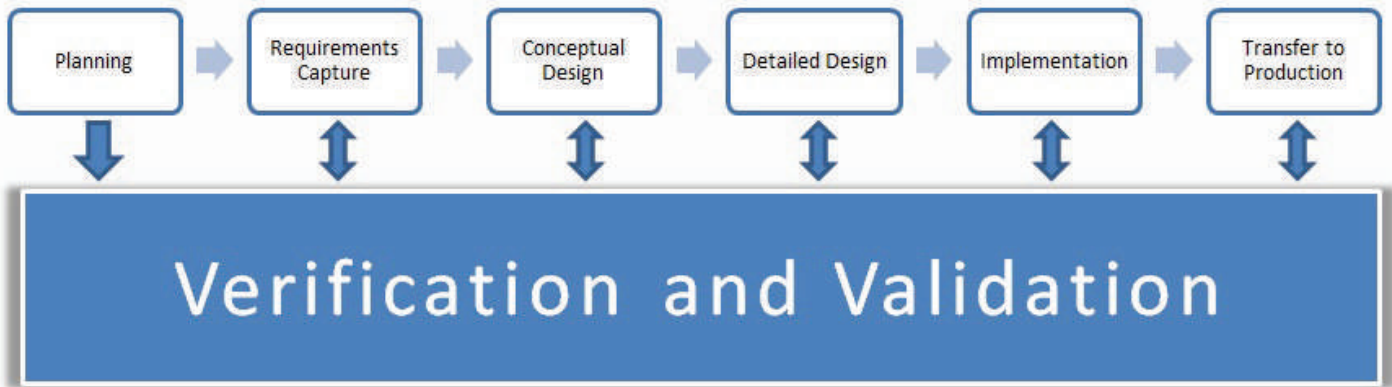
System Driven Approach for Airborne Electronics System

DO-254 - Solutions for Requirements Based FPGA Design Flows

RTCA/DO-254 “Design assurance guidance for airborne electronic hardware” is a standard that is currently being enforced by the federal aviation administration (FAA) and other worldwide aviation certification agencies. The purpose of DO-254 is to ensure the safety of in-flight hardware. All FPGA (or ASIC) devices that go in systems that fly must now adhere to the DO-254 standard. The stringency of the process is dictated by the design assurance level (DAL, or safety rating) of the end system, levels A (highest) through E (lowest). Designing to DO-254 level A/B compliance standards can be a very costly venture. Leveraging training, expertise, and the right tools can help defray much of this added cost.



Siemens solutions deliver a best-practice methodology for requirements based design, to help you meet both your DO-254 and quality objectives while improving the productivity of your flows and valuable resources.



FPGA Design Flow – Verification and Validation

With two decades of HDL-based development tool experience, mentor graphics delivers a range of product solutions from concept to implementation for requirements through project management and development

Requirements Tracking

Track hardware implementation for requirement validation for safety critical projects in medical, transportation, aerospace and military, or any complex ASIC or FPGA design.

Advanced FPGA Synthesis

Designers need a multi-vendor synthesis tool to keep pace with advances in technology. Precision RTL plus is the industry's most comprehensive FPGA solution.

Design Creation

Mentor provides best in class tool supporting techniques and methodologies to accelerate the creation of thousands of lines of code to improve design productivity.

ASIC Prototyping

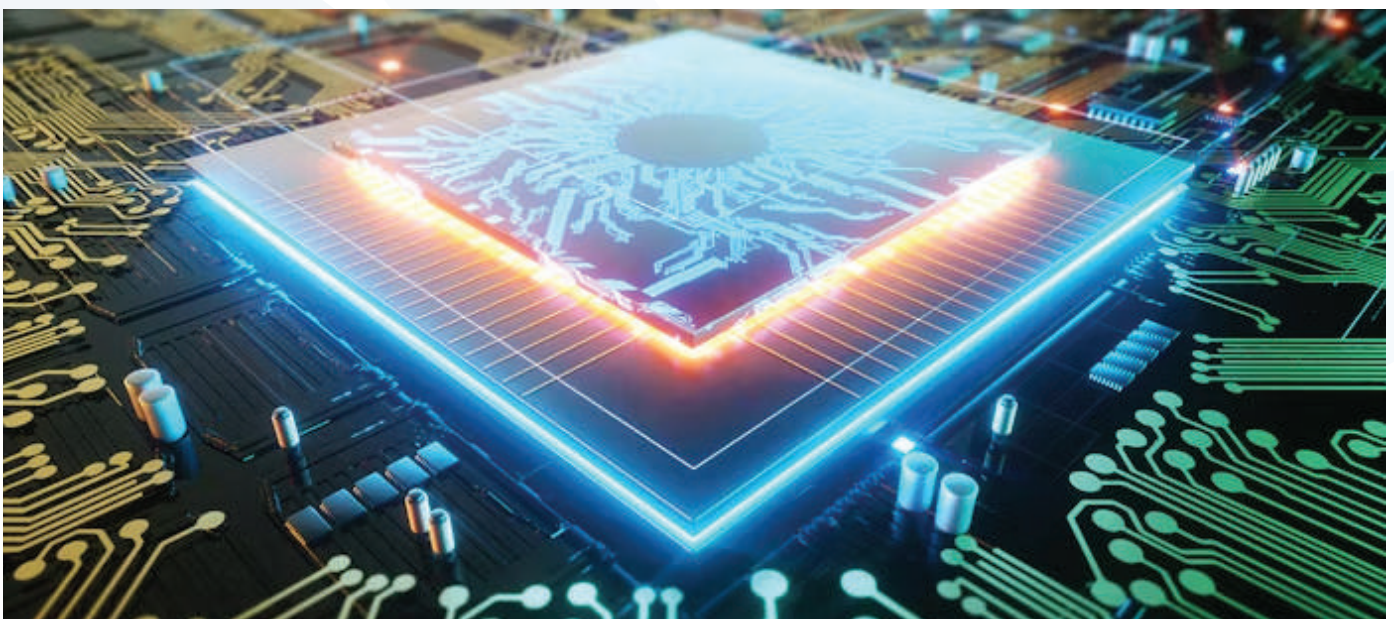
Ease the transition from ASIC to FPGA design by allowing the same HDL code and constraint syntax to be used.

Design Reuse

Adopting new standards, tools, and methodologies will enable you to improve your design creation and reuse of legacy code, informal and formal IP.

Simulation & Verification

Delivering the highest simulation productivity possible with multi-language support, coverage and high-performance simulation engine.

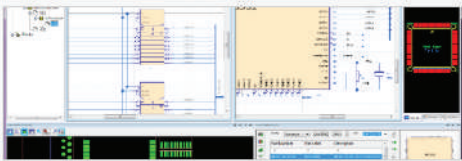


Electronic Design: Concept to Manufacture Portfolio

Xpedition Enterprise

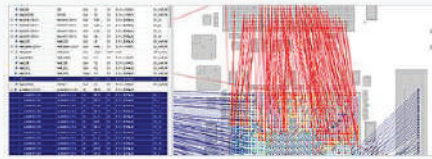
Create competitive advantage across your enterprise

Xpedition® Enterprise is the industry's most innovative PCB design flow, providing integration from system design definition to manufacturing execution. With xpedition enterprise, global engineering teams develop the world's most complex electronics systems in a multi-discipline enterprise environment that delivers competitive advantage to their organizations and advanced products to the marketplace.



Schematic Design

Comprehensive concurrent circuit design and management



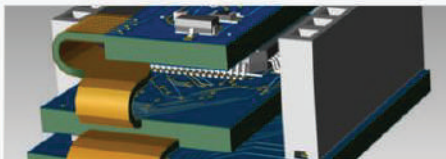
FPGA I/O Optimization

Optimizes I/O on the FPGA for the PCB, and automates symbol creation



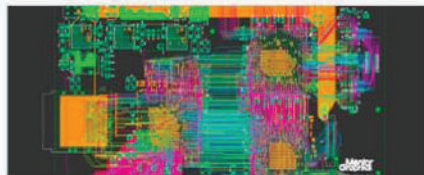
Concurrent Engineering

Accelerate PCB design with dynamic, real-time multi-user layout and distributed auto-routing



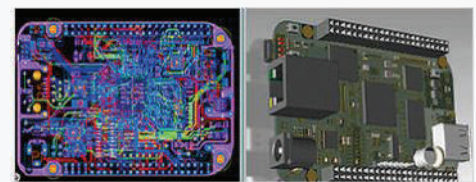
Rigid-Flex Design

Xpedition's correct-by-construction environment simplifies the design process from creation of complex rigid-flex stack-ups.



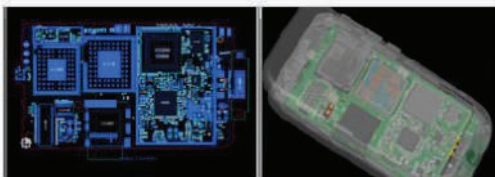
Placement & Routing

An integrated, planning, place and route editing environment.



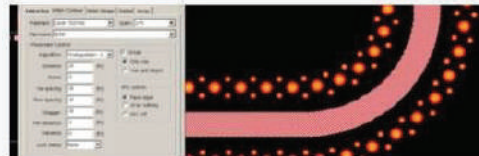
3D Layout

Validate electro-mechanical design problems early with a fully integrated 2D/3D environment.



ECAD/MCAD Collaboration

Enables bi-directional collaboration between the electrical and mechanical domains



RF Design

Position RF, analog and digital circuits directly on the same PCB, with true RF schematics and Agilent/AWR simulator compatibility.

IC Packaging Design & Verification

Monolithic scaling limitations drive the growth of 2.5/3D multi-chiplet, heterogeneous integration that enables PPA targets to be met. Our integrated flow addresses IC package prototyping challenges to signoff for FOWLP, 2.5/3D IC, and other emerging integration technologies.

Xpedition IC Packaging design tools provide a complete design solution for creating complex, multi-die homogeneous or heterogeneous devices using FOWLP, 2.5/3D, or system-in-package (SiP) modules, as well as IC package assembly prototyping, planning, co-design, and substrate layout implementation.

PCB Simulation

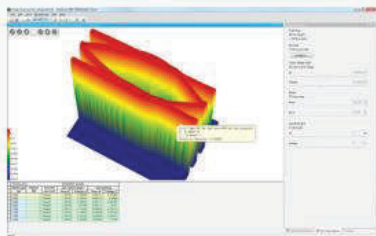
Maximize the benefits of PCB virtual prototyping to develop higher quality products, faster

The Xpedition® enterprise design flow includes a complete suite of high-speed PCB simulation tools, powered by Hyperlynx®. They enhance crucial virtual prototyping capabilities:

- ▶ Analog/mixed-signal simulation
- ▶ Signal integrity analysis
- ▶ Electrical rule checking for SI, PI, EMI issues
- ▶ Thermal analysis
- ▶ Power integrity analysis

Signal Integrity (SI) Analysis

Hyperlynx SI includes tools for pre- and post-layout signal integrity, timing, crosstalk, and EMC analysis, for signals ranging from 0Hz to multi-GHz.

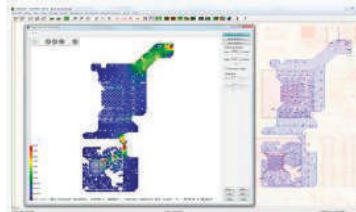


Signal Integrity Analysis

Analyze signal integrity issues early in the design cycle to eliminate costly re-spins

Power Integrity (PI) Analysis

Hyperlynx PI includes pre- and post-layout power integrity analysis, such as DC drop analysis, AC decoupling analysis, plane noise analysis, and model extraction.

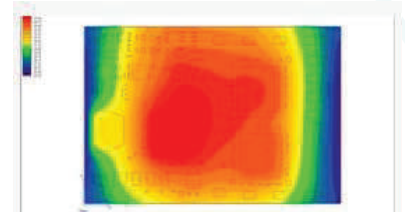


Power Integrity Analysis

Accurately model power distribution networks and noise propagation mechanisms, pre- and post-layout, in the PCB design process

Thermal Analysis

Hyperlynx® Thermal analyzes board level thermal conditions on placed, partially routed, or fully routed PCBs.

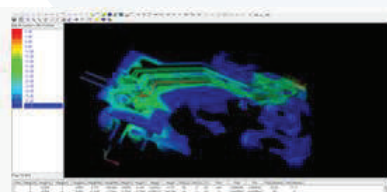


Thermal Analysis

Fast, complete, accurate 3D modeling of complex flow and thermal fields in PCB designs

Full-wave/Hybrid EM analysis

3D, broadband, full-wave electromagnetic field solver for SI, PI, and EMI



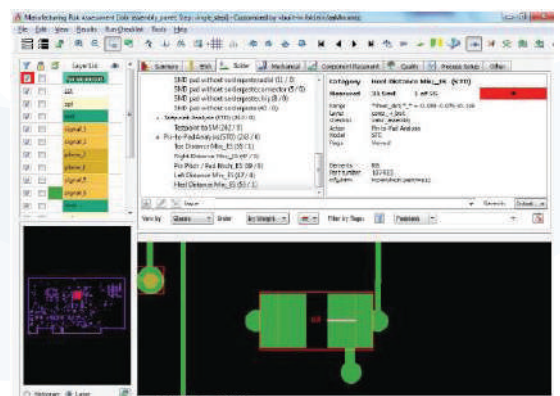
Full-wave/Hybrid EM Analysis

Electromagnetic design and post-layout verification for PCB, packaging, RFIC, MMIC, and planar antenna designs

Valor NPI

Valor NPI captures the technology inherent in the PCB design and associates it with appropriate manufacturing processes to automatically select which DFM rules and values to apply. The result is an intelligent and automated analysis that provides an extremely efficient and effective DFM process.

- ▶ Fabrication
- ▶ Flex/Rigid-flex
- ▶ Assembly
- ▶ Panel
- ▶ Packaging Substrate



Manufacturing risk assessment of yield and reliability.

Reliability & Quality Solutions Portfolio

Our integrated suite of quality and reliability analysis software is built on the **Relyence®** platform – a powerful framework that takes advantage of today’s technology innovations. Relyence provides key insights into product reliability and quality performance, enabling you to achieve and exceed your continuous improvement goals and meet your compliance requirements.

Reliability Prediction

Relyence® reliability prediction supports the worldwide accepted standards for MTBF (Mean Time Between Failures) Analysis: MIL-HDBK-217, Telcordia, 217Plus, IEC 61709, NSWC mechanical, ANSI/VITA 51.1, China’s GJB/z 299, and NPRD/EPRD.

FMEA

Relyence® FMEA supports DFMEAs, PFMEAs, boundary diagrams, P-diagrams, process flow diagrams, control plans, DVP&R, piece-part FMEAs, FMEA-MSRs, and FMD-2016, and includes built-in templates for AIAG & VDA, SAE, and MIL-STD-1629 standards to keep you in compliance.

FRACAS

Relyence® failure reporting, analysis, and corrective action system software provides a complete tracking and control framework for the proper handling of all your issues of concern. Whether you want to track customer complaints, field failure reports, test failures, safety issues, compliance concerns, audit report findings, or any other type of incident.

FTA

The Relyence® fault tree analysis tool offers a comprehensive platform for constructing striking FTA diagrams, modeling an array of input events, and computing a wide range of availability metrics using its highly capable mathematical engine.

RBD

The Relyence® RBD software offers a comprehensive platform for modeling complex systems, including those incorporating redundancy, and computing a wide range of metrics with its highly capable mathematical engine.

RMP

Relyence® maintainability prediction software supports the worldwide accepted standard for maintenance and repair metrics – MIL-HDBK-472. Its organized approach ensures that you remain in compliance and on track.

Weibull

Making Weibull analysis easy! an intuitive, easy-to-use interface is at the heart of the Relyence® weibull software. All the power and versatility of weibull analysis wrapped in a functional, uncomplicated interface.

RCM

Relyence® RCM supports the accepted standards for Reliability Centered Maintenance analysis: SAE JA1011, SAE JA1012, MIL-HDBK-2173, and NAVAIR 00-25-403. Our built-in templates get you up and running in no time.

ALT

Relyence® ALT provides the ability to perform accelerated life testing analysis in a well-designed and easy-to-use interface. Enter your stress data and complete your complex ALT analyses in a clear and streamlined interface.



- ▶ Reliability Prediction
- ▶ FMEA
- ▶ FRACAS
- ▶ Fault Tree
- ▶ Reliability Block Diagram
- ▶ Maintainability Prediction
- ▶ Reliability Centered Maintenance
- ▶ Weibull
- ▶ ALT

Multiphysics CAE Solutions Portfolio

At Trident Techlabs Ltd., we specialize in advanced CAE (Computer-Aided Engineering) software for mechanical engineers. Our software suite empowers engineers across industries with tools for structural analysis, thermal simulations, and multi-physics modelling. This enables cost-effective product development by reducing testing and iteration cycles. From aerospace to automotive, Multiphysics cosimulation provides engineers with more complete and holistic performance insight by coupling together multiple simulations- from acoustic simulation to multibody dynamics, CFD to structural analysis, explicit crash dynamics etc to be coupled, giving greater insights in design for better overall performance.

FEM Multiphysics:

TECHLABS empower engineering solutions, we collaborate with you to support & develop leading-edge devices

Join us to meet your broader business goals.....

Fluid Mechanics

► Computational Fluid Dynamics (CFD)

FEM/FVM multiphysics software provides advanced CFD capabilities, enabling detailed simulations of fluid flow based on the conservation of momentum, mass, energy, and species material balances. It supports both Newtonian and non-Newtonian fluids, with predefined rheology models such as Power law, Carreau, and Bingham. A comprehensive range of Reynolds-averaged Navier-Stokes (RANS) turbulence models and large eddy simulations are available for capturing complex flow behaviors.

► Specialized Flow Models

The software can handle specialized flow scenarios, including thin film flows, multiphase flows, and porous media flows. It supports high Mach number flows and fluid-structure interactions, making it suitable for a wide range of applications. For porous media, the software can model transport phenomena using Darcy's law and more advanced models such as Brinkman equations for non-Darcian and multiphase flows. The software includes templates for modeling mixers, tanks, and impeller blades.

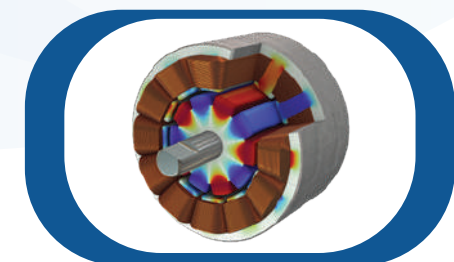
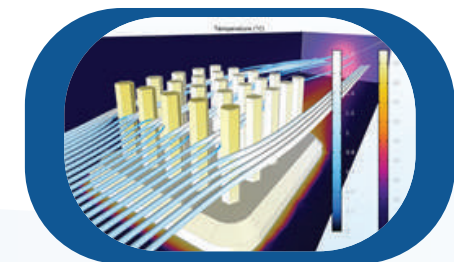
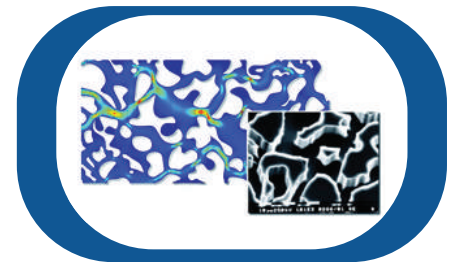
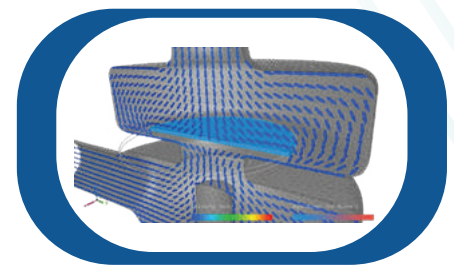
► Heat Transfer

Heat transfer analysis is integral to many engineering applications. The FEM software can model heat transfer through conduction, convection, and radiation. It supports both laminar and turbulent flows, natural and forced convection, and can handle conjugate heat transfer scenarios. The software is capable of modeling heat transfer in thin layers, shells, and fractures, and can account for phase changes, making it versatile for a range of thermal management problems.

Electromagnetics

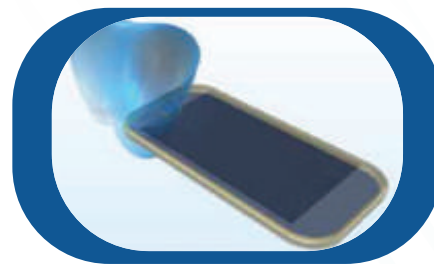
► Low Frequency Electromagnetics

For applications involving static and low-frequency electromagnetic fields, the software offers comprehensive modeling tools. Users can model coils, transformers, inductors, motors, and actuators using a library of parametric coil and magnetic core shapes. The software includes moving mesh functionality to capture eddy current losses and other dynamic effects in these components.



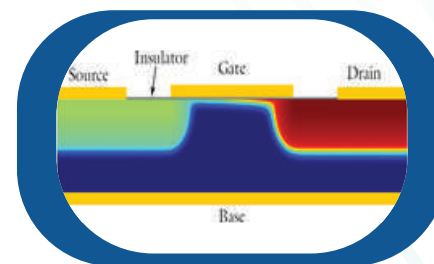
► *High Frequency RF Modeling*

High-frequency electromagnetic applications, such as RF and microwave engineering, are supported with tools for modeling antennas, far-field radiation patterns, and phased arrays. The software enables detailed analysis of S-parameters, input impedance, and other RF characteristics. It also supports advanced applications such as microwave sintering, spectroscopy, millimeter-wave and terahertz radiation, and near-field communication.



► *Semiconductor Modelling*

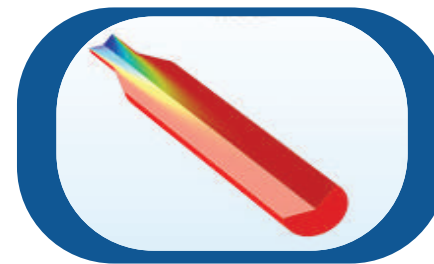
For semiconductor device analysis, the software provides models based on drift-diffusion equations, density-gradient formulations, and quantum mechanics approaches (Schrödinger and Schrödinger-Poisson equations). It supports both isothermal and nonisothermal transport models, allowing for the simulation of quantum-confined systems such as quantum wells, wires, and dots.



Electrochemistry

► *Chemical Engineering*

In chemical engineering, FEM multiphysics software can simulate material transport and heat transfer combined with arbitrary chemical kinetics in various environments, including gases, liquids, porous media, and solid phases. The Chemical Reaction Engineering allows users to define and analyze material transport in dilute and concentrated solutions, incorporating convection, diffusion, and ionic migration of chemical species. It supports the definition of reversible, irreversible, and equilibrium reaction kinetics.



► *Batteries and Fuel Cells*

The software includes specialized modules for studying batteries and fuel cells, such as Lead-Acid, Lithium-Ion, Nickel-Metal-Hydride, Solid Oxide fuel cells (SOFCs), and Proton Exchange Membrane fuel cells (PEMFCs). It models the electrochemical behaviour in the electrodes and electrolytes, supporting simulations of cyclic voltammetry and electrochemical impedance spectroscopy (EIS). The software also facilitates parameter estimation and data analysis for these electrochemical systems.



► *Corrosion Analysis*

Corrosion analysis capabilities are crucial for understanding and mitigating the effects of corrosion on structures. The software can simulate corrosion processes at both microscale and macroscale levels, helping to protect structures from corrosion damage. It incorporates electrochemical reaction kinetics models such as Tafel and Butler-Volmer equations to accurately represent corrosion mechanisms and predict the lifespan of materials in corrosive environments.



Multibody Dynamics

Utilizing multibody dynamics solution technology, software runs nonlinear dynamics in a fraction of the time required by FEA solutions. Loads and forces computed by simulations improve the accuracy of FEA by providing better assessment of how they vary throughout a full range of motion and operating environments.

Structural Analysis

A multidisciplinary structural analysis application used by engineers to perform static, dynamic, and thermal analysis across the linear and nonlinear domains, complemented with automated structural optimization and award winning embedded fatigue analysis technologies, all enabled by high performance computing.

Rotordynamics

Rotor dynamics, is the study of the behavior and performance of rotating machinery components, primarily focusing on the dynamics of rotors. Multiphysics based modeling can be used to simulate fatigue, analyze sound propagation, and investigate the interactions between stationary and moving components, such as the interactions between a spinning shaft and hydrodynamic bearings.

Acoustics

Complete CAE software suite for acoustic, vibroacoustic and aero-acoustic. Empowered by the technologies of finite/infinite element methods (FE/IFE), as well as the Discontinuous Galerkin Method (DGM), it provides a rich library of materials, elements, boundary conditions, solution schemes and solvers.

Composites

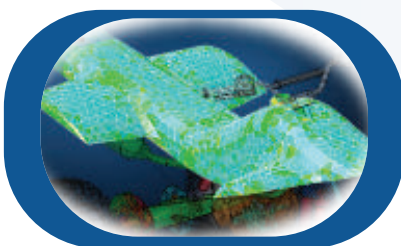
A state-of-the-art multi-scale material modeling technology that helps speed up the development processes for plastic & composite materials and structures in order to accurately predict the nonlinear micromechanical behavior of complex multi-phase composite materials and structures.

Welding & Assembly Simulation

A comprehensive tool for virtual assessment of material characteristics, microstructure, residual stresses and distortions in welded structures and assemblies. The software addresses different welding processes (arc, electron beam, laser and spot welding) and heat treatment processes (carburizing, carbonitriding, and quenching) and considers all relevant phenomena (chemical, thermal, metallurgical and mechanical).

Casting Simulation

Casting Simulation Suite, ProCAST enables predictive evaluations of the entire casting process, including filling and solidification defects, mechanical properties and complex part distortion. Software addresses most castable alloys and casting processes such as sand casting, die casting, investment casting, and their multiple process variants.



- ▶ RotorDynamics
- ▶ Multiphysics co-simulation
- ▶ Battery Design
- ▶ Virtual Product Development
- ▶ MEMS
- ▶ RF
- ▶ Marine
- ▶ Chemical Reaction Engineering

Power Electronics Simulation Portfolio

Power simulation is integral to modern design, enabling the development of advanced, efficient, and reliable power electronics systems. As technology evolves, power simulation continues to adapt, incorporating new techniques and tools to meet the demands of emerging technologies and complex systems. Power electronics simulation helps in designing efficient DC-DC converters, AC-DC converters, and inverters used in renewable energy systems, electric vehicles, and consumer electronics and optimizing electric motor drives for performance and efficiency, including advanced control strategies.

PSIM

PSIM is circuit simulation software package, designed specifically for use in power electronics and motor drive simulations but can be used to simulate any electronic circuit. PSIM can handle quick power converter loss calculations, motor drive efficiency calculations, Conduct EMI analysis, and analog/digital control. PSIM also offers automatic embedded code generation for rapid control prototyping. Additionally, with PSIM's various Design Suites, users can design power supplies, electromagnetic interference (EMI) filters, and motor drive systems quickly and conveniently.

Motor Control Design

The motor control design suite provides a very quick way of designing a motor drive system from user specifications. design template for linear and nonlinear PMSM with MTPA and field weakening control.

Power Supply Design

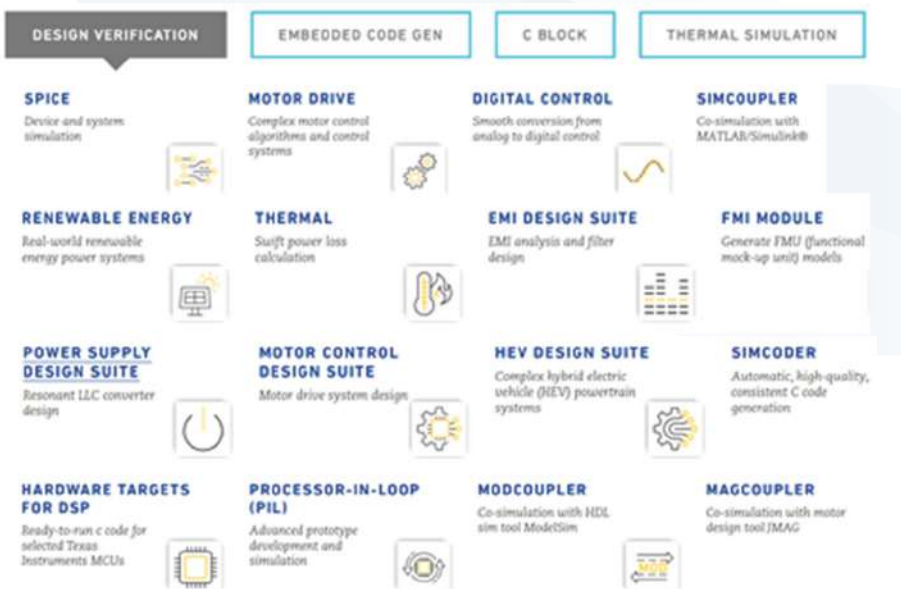
Power supplies are the backbone of the electrified world. Converter requirements, advancements in semiconductor devices, magnetics, topologies, and control techniques require dynamic, accurate, and purpose-built power electronics simulation tools.

EV/HEV Powertrain Systems

Power electronics and motor drives are at the heart of EV/HEV powertrain systems. With PSIM's design suites, teams can set up and start simulating an HEV powertrain system in no time. This helps system engineers, hardware engineers, and control engineers study the system's aspects and speed up the development process.

EMI Design Suite

The EMI Design Suite provides a total solution of conducted EMI analysis and EMI filter design for power converter systems. The EMI Design Suite helps users walk through iteration steps of conducted EMI pre-compliance in a typical a power converter product development cycle. Based on the selected EMI standard, the Design Suite automatically designs the EMI filter with proper attenuations for both Differential Mode (DM) and Common Mode (CM) conducted emission noises, and generates a system that is operational and ready to simulate. EMI Design Suite provides a very quick design to the EMI filter development, and helps speed up the EMI pre-compliance process substantially.



- ▶ Power Electronics
- ▶ Controls & Systems
- ▶ Motor Drive
- ▶ Renewable Energy
- ▶ HEV

Multi Domain System Simulation Portfolio

Modern mobility & machinery products are complex, connected, and dynamic systems. They consist of a multitude of components and subsystems, usually based on diverse technical domains, and are increasingly fitted with sensors and controls. Their dynamic interactions have a significant impact on safety, performance, and comfort. With SimulationX, engineer's model, simulate, and analyze the behavior of all parts of the technical systems comprising mechanical, hydraulics, pneumatics, electronics, thermal, and control systems. Comprehensive component libraries with application-oriented model elements ensure that they have the right tools available for each task.

Multi-Domain System Simulation

SimulationX supports modelling in multiple domains such as mechanical, electrical, hydraulic, pneumatic, and thermal systems. This allows for the creation of integrated models that simulate interactions between different physical domains.

Virtual Vehicle Modelling and Simulation

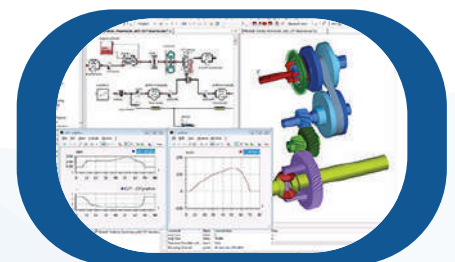
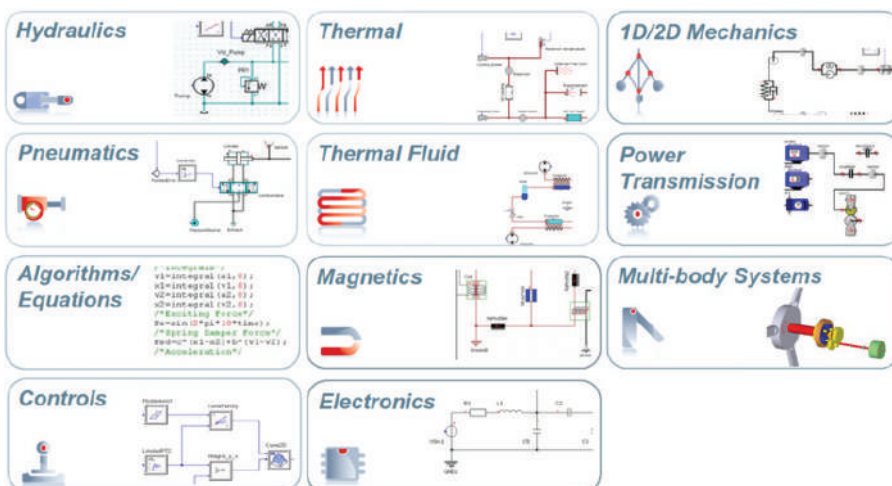
Virtual prototyping and virtual testing are crucial in today's mobility industry because of their ability to meet increasing market demands and ensure products adhere to industry requirements and quality standards. When integrated into the design and engineering process, these tools enable customers to deliver innovative and scalable products. SimulationX leverages the power of 1D modeling, allowing for early design changes and validation. This approach ensures that results are transparent and accessible at any point in the development process.

Fluid Power Systems

The complexity of fluid power systems is inevitable due to the involvement of fluid, mechanical, electrical, thermal & control systems all together. Depending on the application and industry, hydraulic or pneumatic systems are used to deliver high precision, faster response time, and high power density. With a legacy of modeling hydraulics & pneumatics systems accurately for years, simulationX has a wide area of applications covered, spanning various industries. Modeling mechatronic systems in heavy machinery with hydraulic actuators and control units is one of the strong areas of simulationX.

Electrification & Energy Management

Complex requirements concerning energy efficiency, renewable energies, and electrification demand a solution approach that is safe, sustainable, and cost-effective. Especially automotive electrification technology is an emerging global trend. SimulationX delivers tailored solutions for EV battery range prediction, energy management, green hydrogen & alternate energy sources with its comprehensive library support and continuous development towards newer and innovative energy solutions.



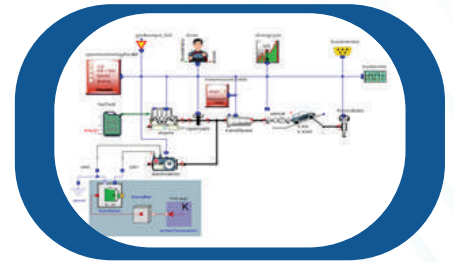
- ▶ Multi Domain System
- ▶ Virtual Vehicle Modelling
- ▶ Fluid Power Systems
- ▶ 1D/2D/3D Mechanics
- ▶ Thermics and Thermal-fluid
- ▶ Batteries and Hydrogen Fuel Cells
- ▶ Energy Systems
- ▶ Electro-magnetics
- ▶ Hydraulics
- ▶ Pneumatics

▶ *Vehicle Level Simulations for Suspension Design*

Vehicle level simulations for suspension design involve creating detailed models of a vehicle's suspension system to analyse and optimize its performance under various driving conditions. These simulations assess factors such as ride comfort, handling, and durability by evaluating how the suspension interacts with road surfaces and responds to dynamic loads.

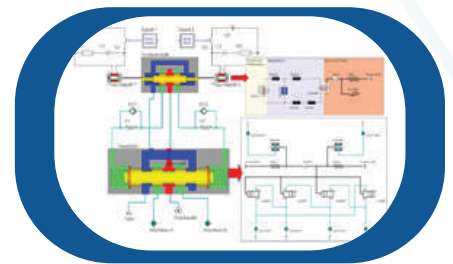
▶ *Electric/Hybrid/Manual Powertrain Simulations*

Simulations of electric, hybrid, and manual powertrains involve modelling and analysing different propulsion systems to optimize performance, efficiency, and control. This includes motor control strategies for electric and hybrid vehicles, regenerative braking to recover energy during deceleration, and friction braking for manual powertrains. These simulations help in evaluating energy consumption, optimizing power delivery, and ensuring seamless integration of various powertrain components. Batteries or fuel cells can be considered for such simulations.



▶ *Air Conditioning Simulations*

Air conditioning simulations model the thermal performance and energy efficiency of HVAC systems in vehicles or buildings. These simulations analyse heat transfer, fluid flow, and refrigeration cycles to optimize system design, control strategies, and overall comfort. They help in assessing the impact of different components and operating conditions on cooling efficiency and power consumption.

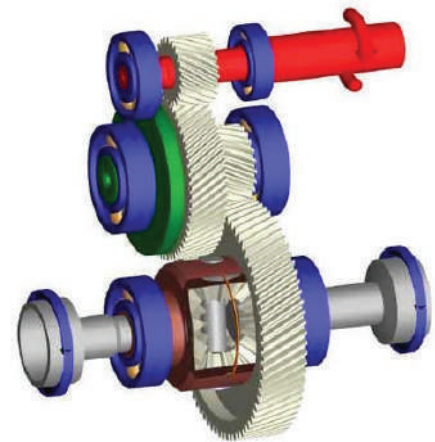


▶ *Anti-lock Braking System (ABS) Simulations*

ABS simulations focus on modelling the functionality of anti-lock braking systems to prevent wheel lockup during braking. These simulations evaluate the effectiveness of ABS algorithms in maintaining vehicle control and stability, especially under adverse conditions. They help in fine-tuning the control logic and improving safety and performance.

▶ *Pulleys with Ropes Simulations*

Simulations of pulleys with ropes analyse mechanical systems involving pulleys, ropes, and their interactions. These simulations evaluate the efficiency of power transmission, load handling, and system stability. They are crucial for optimizing pulley designs and ensuring reliable operation in various lifting and transportation applications.



▶ *Gearbox Simulations*

Gearbox simulations focus on modelling the behaviour and performance of gear systems within machinery and vehicles. These simulations analyse gear interactions, load distribution, and wear patterns to optimize gear design, enhance efficiency, and ensure reliable operation under different conditions.

▶ *System Fault Simulations*

Simulations of system faults involve modelling various failure scenarios such as leaks, blockages, broken shafts, and electrical connections. These simulations help in diagnosing potential issues, assessing their impact on system performance, and developing strategies for fault detection and mitigation to ensure system reliability and safety.

▶ *Fluid power Systems Simulations*

Modelling hydraulic and pneumatic circuits, including pumps, valves, accumulators, and actuators, along with their interactions with other physical systems.

Design Services Portfolio

The design services arm of Techlabs is focused to address turn-key product engineering of electronic systems. This group is focused on NPI, which goes beyond design engineering to ensure optimal design parametric to ensure high volume production at optimal costs and assured reliability. With designs using faster devices to meet demanding specifications that match or beat the competition. Techlabs design team offers services right from specifications to system level architecture design, implementation and verification to the final delivery.

DO254 Services

DO-254 is a standard developed by the RTCA (Radio Technical Commission for Aeronautics) that addresses the design and verification of airborne electronic hardware.

- ▶ **Verification and validation:** Services that focus on the testing and validation of hardware to ensure it performs correctly and meets DO254 guidelines.
- ▶ **Documentation support:** Assistance in preparing and organizing the extensive documentation required by DO-254, including design plans, verification plans, and traceability matrices.
- ▶ **Training:** Offering training sessions or workshops to help teams understand DO-254 requirements.

Board Design and Analysis:

▶ PCB Design

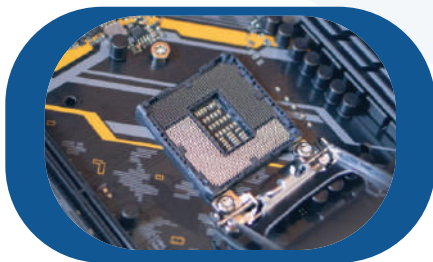
Design of the complex interconnects - "PCB engineering" mandates that interconnects must meet the high switching rise/fall times of current day processors, memories and interface devices. This requires identifying high-speed design problems during the early stages of design by using CAE tools and in depth expertise to fix the same. This includes modeling and analysis of the connection topologies for performance in Gigabit domains.

▶ SI/PI/TI Analysis

Ensuring delivery of valid signal at the receiver end in high speed designs is becoming a challenging task for a designer. This aspect of the impact of the interconnections on performance is overlooked many a time. Techlabs team with its experience in providing solutions in analyzing designs till 12.5Gbps is a key differentiator when ensuring a functional design in current day design technologies that use differential signaling and DDRx modules. The team can proactively address pre-layout and post layout validation of the design and validate for reflections, topologies, crosstalk and EMC to industry standards.

Reliability Services:

Reliability focuses on the ability of a product to perform its intended function. Performing a reliability analysis includes a number of different analyses on a product to anticipate how reliable that product is. Based on analysis results, it is possible to anticipate the effects of design changes and determine the corrections needed to improve reliability. Techlabs team with its ability to support reliability analysis tool Relyence, can provide necessary analysis of products for compliance as per MIL-HDBK-217, 217+ or Telcordia SR-332 etc.



- ▶ DO-254 process
- ▶ Signal Integrity
- ▶ Reliability Services
- ▶ V &V /FPGA /ASIC /SOC
- ▶ Emulation Services*
- ▶ Power Integrity
- ▶ Training Services
- ▶ PCB Design and Analysis
- ▶ Thermal Design
- ▶ NI Based System Automation

*In collaboration with siemens consultancy

CAE Analysis Services

CAE analysis services provide critical insights that drive innovation and efficiency in product development. Advanced simulation tools and modeling techniques are used to evaluate and optimize product designs before physical prototypes. Services are essential across various industries, including aerospace, automotive, electronics, and structural engineering, for improving performance, ensuring safety, and reducing development costs.

Hydraulic/ Electro Hydraulics System Analysis

- ▶ Pump, motor, accumulator, pressure/flow/directional valve, actuator circuits for controlling load motion

PID Control System Analysis

- ▶ Feedback control systems using transfer-function/ state-space methods

Mechanical System Analysis

- ▶ Assigning joints and motions to various parts within an assembly to analyse its dynamic behaviour

Electrical System Analysis

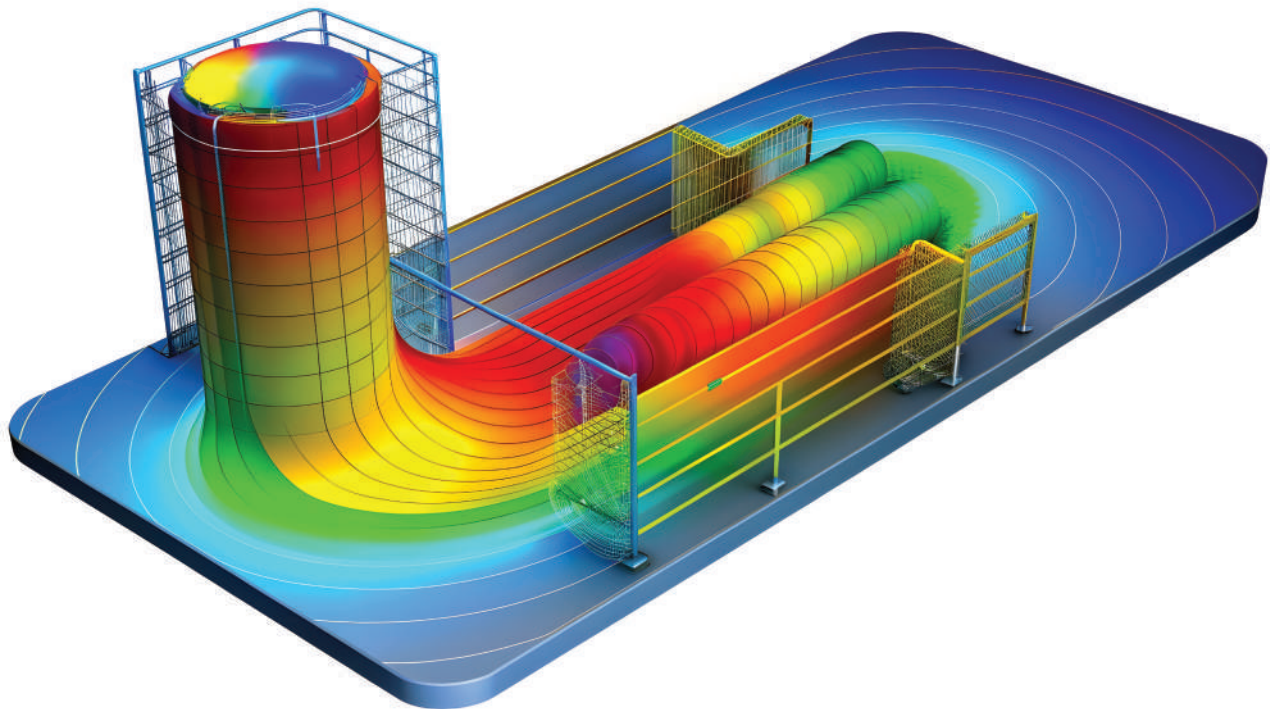
- ▶ Modeling and simulation of Electrical drive systems consisting of Rectifier, Inverter, DC/DC converter, 3-phase/- stepper motors, field oriented control and space vector modulation for switching control

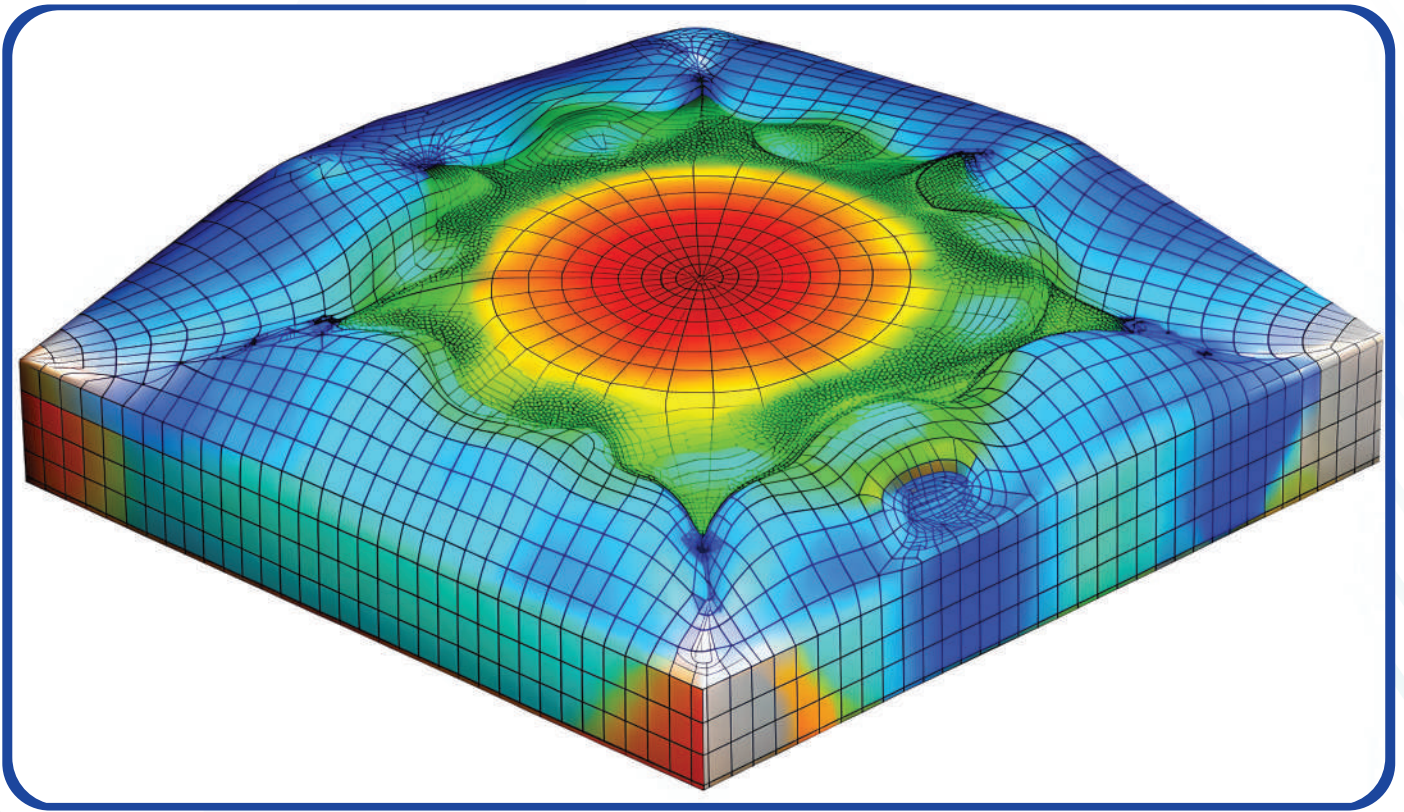
Thermal System Analysis

- ▶ Modelling of HVAC systems to plot psychrometric charts; calculation of oil temperature rise in hydraulic circuits; modelling of various heat -exchangers

Power-Transmission Analysis

- ▶ Modeling of various powertrains including engines, gearboxes, batteries, drive cycles, pulleys and winches etc





Deformation and Stress Analysis

- ▶ Geometric, material, contact nonlinearity
- ▶ Vibration (Response spectrum, random vibration)
- ▶ Multi body dynamics
- ▶ Composite materials
- ▶ Fatigue
- ▶ Crack propagation (J-integral, SERR, CTOD, SIF)

Computational Fluid Dynamics:

- ▶ Single-phase/Multiphase (separated/dispersed) flow
- ▶ Non-isothermal flow and conjugate heat transfer
- ▶ High mach number flow
- ▶ Reacting flow
- ▶ Thin-film and porous media flow
- ▶ Turbulent Flow (RANS, LES, DES)

Acoustics:

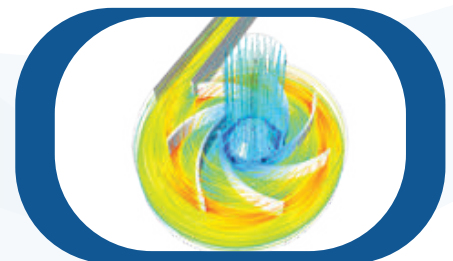
- ▶ Vibroacoustics (acoustic-structure)
- ▶ Aeroacoustics (convected acoustics)
- ▶ Electroacoustics (fully coupled or lumped)
- ▶ Piezoelectric materials
- ▶ Porous materials (Biot's equations)

Vehicle Dynamics

- ▶ Hydraulic/Air suspension
- ▶ Lane change maneuvers
- ▶ Pneumatic braking
- ▶ EV/hybrid vehicle

Battery and Fuel Cells

- ▶ Porous electrodes
- ▶ Current distributions
- ▶ Dilute and concentrated electrolytes



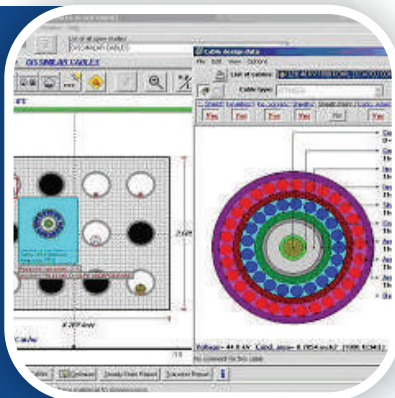
- ▶ System Level Simulation
- ▶ Mechanical FEM/CFD
- ▶ Multiphysics FEM
- ▶ Manufacturing FEM
- ▶ Fluid Mechanics
- ▶ Solid Mechanics
- ▶ Mechanical Heat Transfer
- ▶ Mechanical Acoustics
- ▶ Electromagnetics
- ▶ Electrochemical
- ▶ Battery Design

Power System Solutions Portfolio



- ▶ **Transmission Analysis**
- ▶ **Industrial Analysis**
- ▶ **Planning and Engineering**
- ▶ **Arc Flash Risk Assessment**
- ▶ **Distribution Power Analysis**

- ◀ **Substation Design**
- ◀ **Model Management**
- ◀ **Lightning Protection Calculation**
- ◀ **Sag Calculation**



- ▶ **Cable Ampacity Calculations**
- ▶ **Protective Device Coordination**
- ▶ **Grounding Grid Design & Analysis**
- ▶ **Distribution Reliability**

- ◀ **Phase ID System**
- ◀ **Clearance Calculation**
- ◀ **DC System Analysis**
- ◀ **Distribution Energy Resources (DER)**



Contact us

For any further information or clarification, please do contact us



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