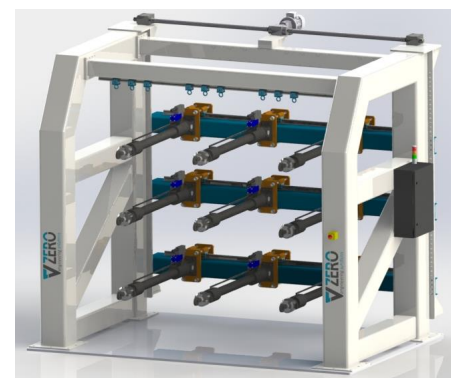
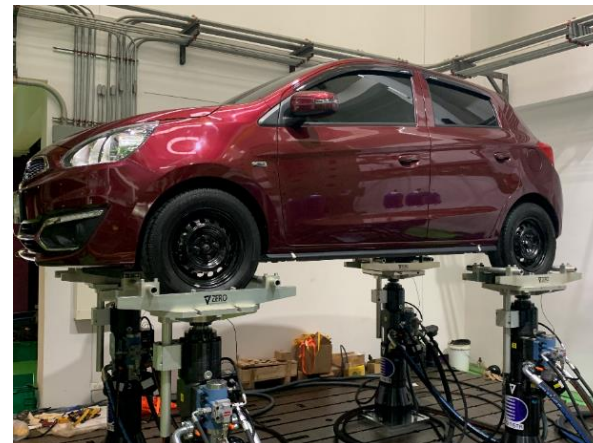
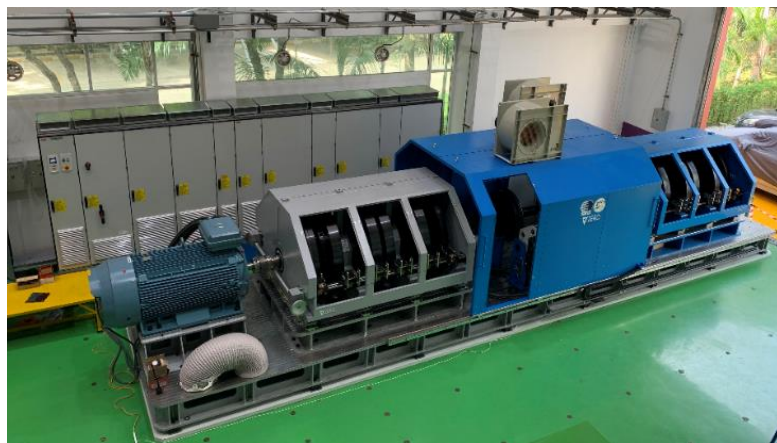


TEST AND MEASUREMENT DAYS, October 2023



- 1. Introduction**
- 2. Products**
- 3. Services**
- 4. Customers**
- 5. Contact information**

1. **Introduction**
2. **Products**
3. **Services**
4. **Customers**
5. **Contact information**



1-INTRODUCTION

History and expertise

HISTORY

- VZERO was founded in 2015, in response to the market needs for **high quality, cost effective advanced engineering solutions**.
- VZERO's develops its activity mainly in the engineering fields of **Motion Simulation, Structural Testing Systems and Passive Safety Testing Systems**.
- The target markets of VZERO are **automotive, railway, aerospace and civil works industries**.
- VZERO's core team accumulates **more than nineteen years** of experience in the abovementioned fields and has taken part in **complex projects worldwide**, always achieving customer satisfaction thanks to the experience and **strong technical background** of all of its members.

EXPERTISE

Our team features a **strong engineering background and experience**, in the following fields, among others:

- Support in requirements definition. Techno-economical feasibility studies.
- Systems engineering
- Civil works design
- Advanced mechanical design. **Advanced FEM and CFD analyses. Multi-physics dynamic simulations.**
- Hydraulic and Pneumatic engineering. **Advanced servohydraulic actuation technologies.**
- Electrical, Electronics and Instrumentation engineering. **Advanced electromechanical actuation.**
- **Advanced Control and Software engineering**
- Installation, commissioning and training to customers
- After-sales service



1-INTRODUCTION

Business Areas



Automotive

**Advanced Mechanical
Engineering**

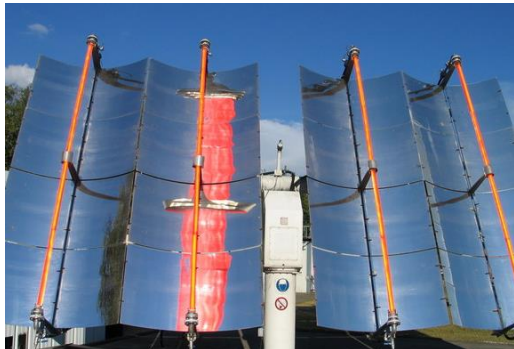
Aerospace



Railway

**Advanced Control and
Software Engineering**

Energy



Civil & Seismic

Servoactuation Technologies

Other Industries

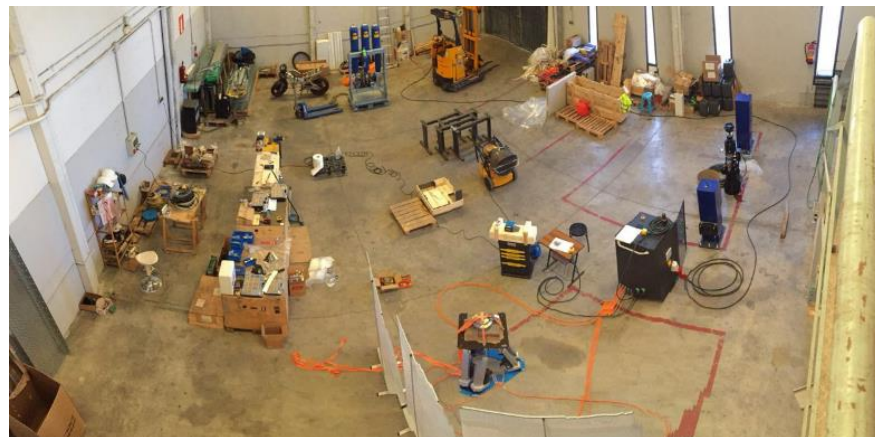




1-INTRODUCTION

Our location

LOCATION



1. Introduction
2. **Products**
3. Services
4. Customers
5. Contact information

Motion Simulation Platforms

MOTION SIMULATION PLATFORMS

Technical features:

- Payload: from 5 kg to 5000 kg. Higher payloads on demand.
- Actuation technology: electromechanical or hydraulic depending on payload and dynamic requirements.
- Degrees of freedom: 1 (horizontal or vertical), 2 (horizontal), 3 (translations or rotations), 6. Customized.
- Frequency range: up to 20 Hz. Higher frequency ranges on demand.
- Easy integration with third party software for DoF references generation in real time

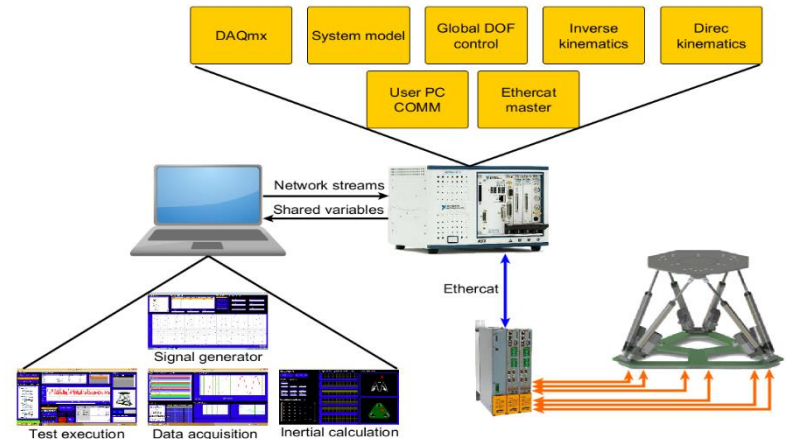
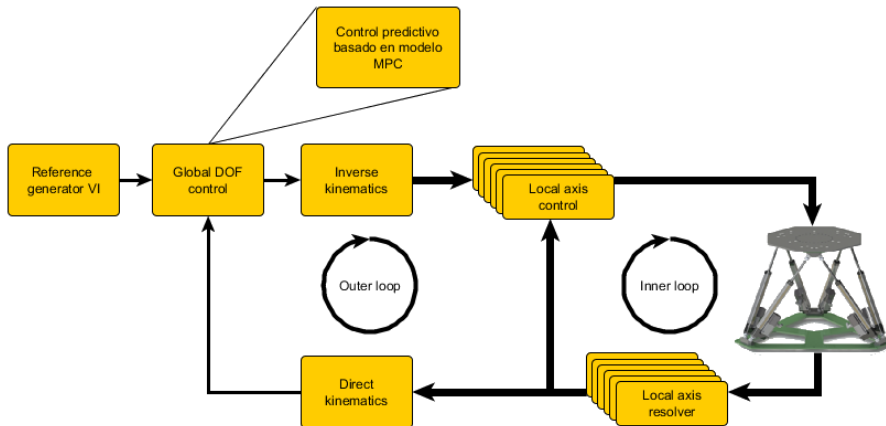
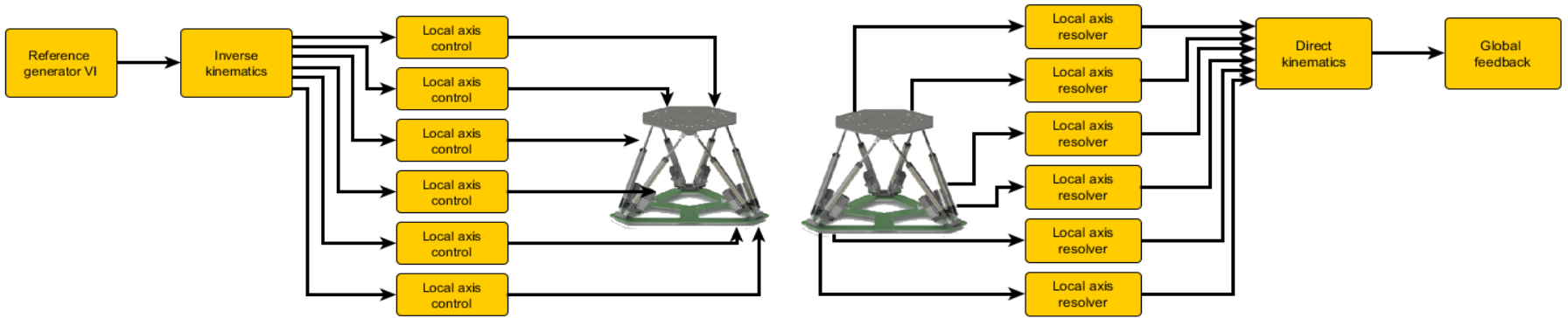
Applications:

- Driving simulation
- Flight simulation
- Ship motion simulation
- Heavy machinery simulation
- Military vehicles simulation
- Earthquake simulation
- Academic resource



2-PRODUCTS

MOTION SIMULATION PLATFORMS



MOTION SIMULATION PLATFORMS



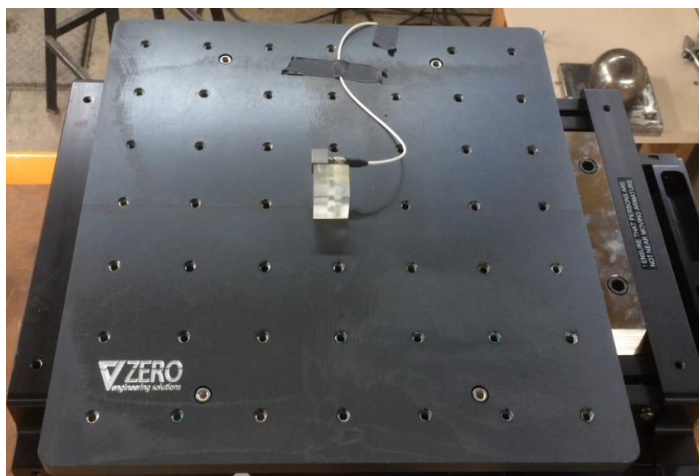
MOTION SIMULATION PLATFORMS



MOTION SIMULATION PLATFORMS

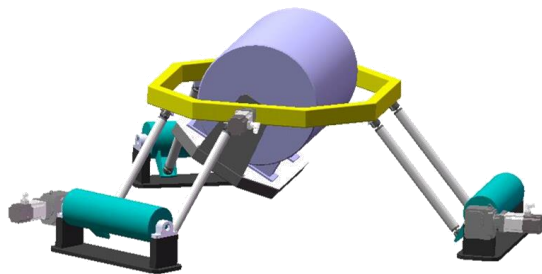
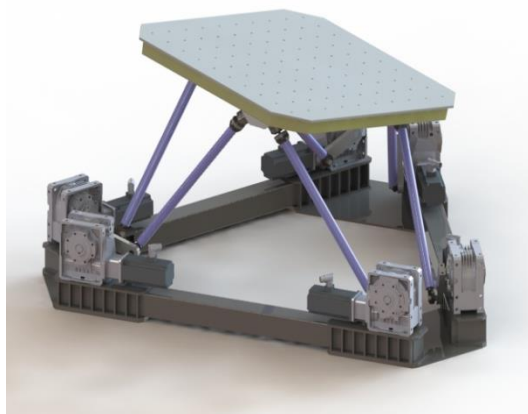
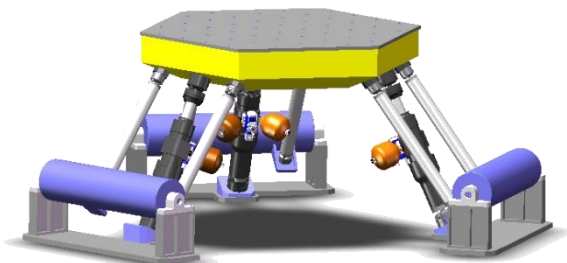
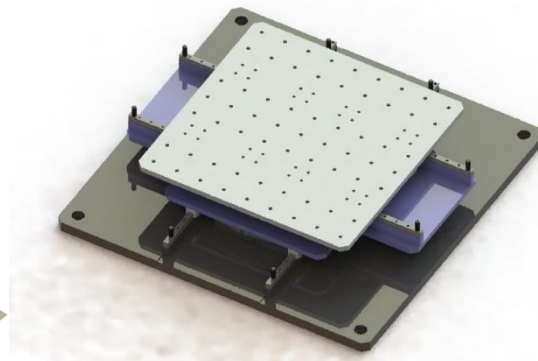
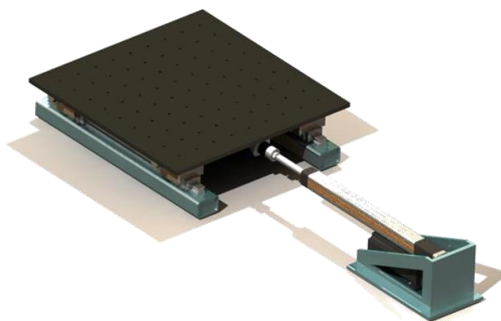
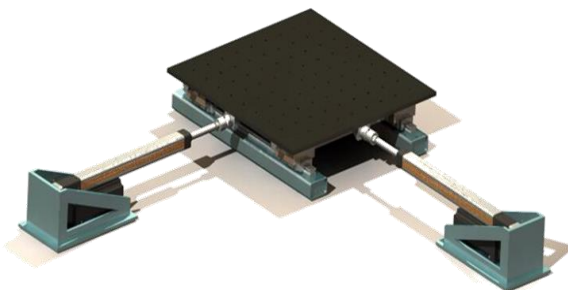


MOTION SIMULATION PLATFORMS



2-PRODUCTS

MOTION SIMULATION PLATFORMS



Structural Testing Systems

STRUCTURAL TESTING: QUASI-STATIC AND PSEUDO-DYNAMIC TESTING SYSTEMS

- **Technical features**
 - Actuator loads up to 1 MN. Others on demand.
 - Actuator strokes up to 1 m. Others on demand.
- **Scope of supply:**
 - Civil works detailed design: pit, retaining walls, strong floor, reaction walls.
 - Hydraulic servoactuators including displacement transducers, load cells and high performance servovalves.
 - Servoactuators fixation elements: ball swivels, flanges, etc.
 - Hydraulic power unit and hydraulic service manifold. Piping
 - Real time controller and user interface application.
 - Pseudodynamic testing: software application for restoring forces identification and motion equations integration. Able to change from actuators reference system to physical working coordinates.
 - Data acquisition hardware and instrumentation: strain gauges, lvdts, etc.
- **Applications:**
 - Monotonic and cyclic testing of structures for structural behavior characterization
 - Evaluation of actual seismic response of certain structures

STRUCTURAL TESTING: QUASI-STATIC AND PSEUDO-DYNAMIC TESTING SYSTEMS

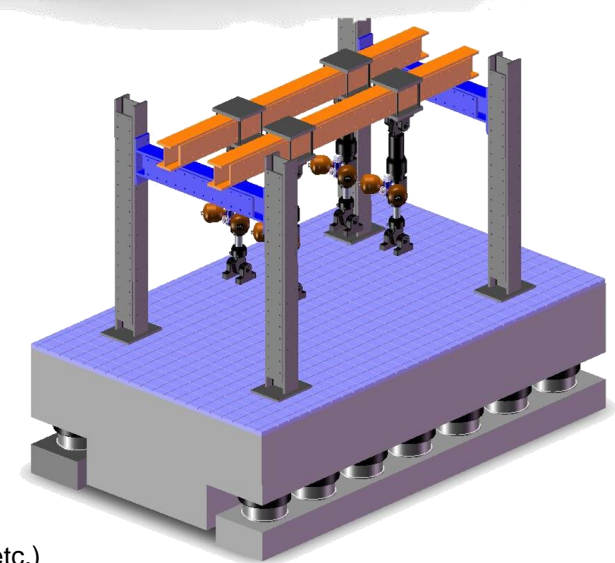
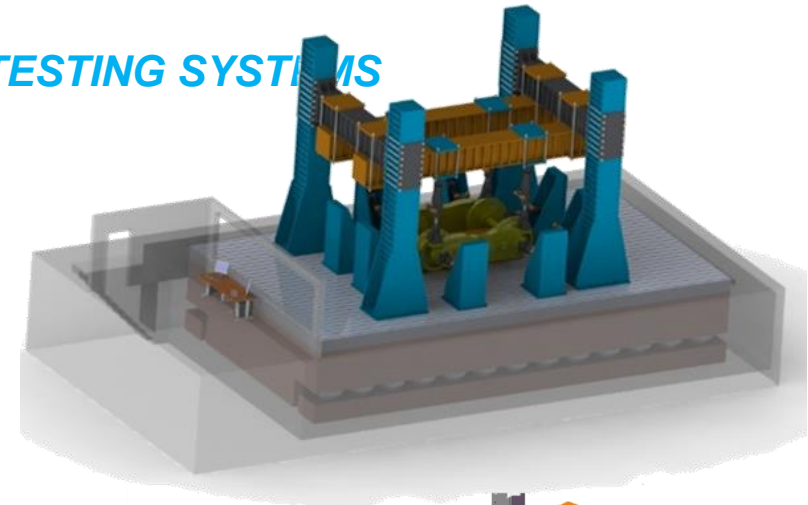


STRUCTURAL TESTING: QUASI-STATIC AND PSEUDO-DYNAMIC TESTING SYSTEMS

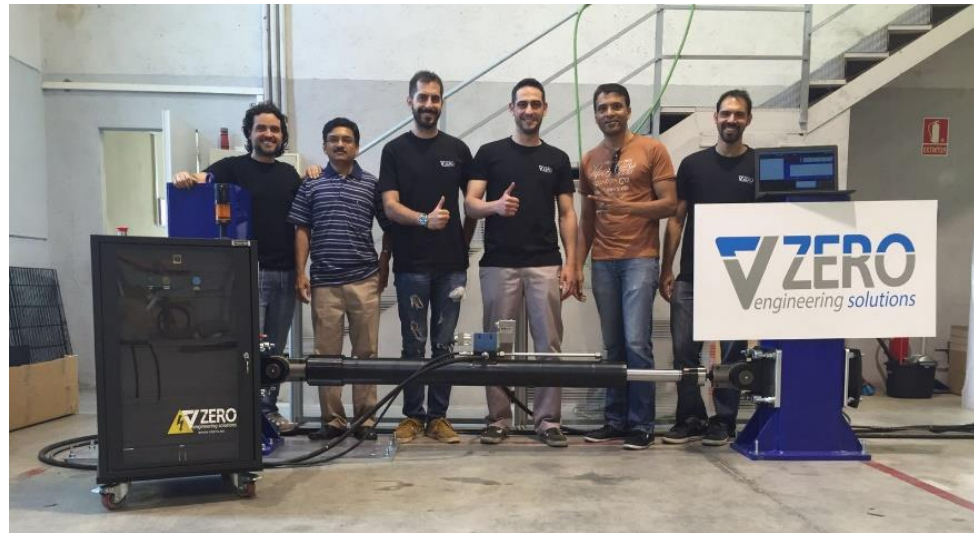


STRUCTURAL TESTING SYSTEMS: DYNAMIC TESTING SYSTEMS

- **Technical features**
 - Actuators load up to 1 MN. Other payloads on demand.
 - Actuators stroke up to 1 m. Other strokes on demand.
 - Velocities up to 5 m/s. Higher velocities on demand
- **Scope of supply:**
 - Civil works detailed design: pit, retaining walls, slab, reaction mass.
 - Isolation system: air-spring based.
 - Modular reaction frames
 - Hydraulic servoactuators including
 - Displacement transducers, load cells, accelerometers.
 - High performance servovalves.
 - **Hydrostatic or hydrodynamic rod bearings.**
 - Pressure and return accumulators.
 - Servoactuators fixation elements: **adjustable backlash swivels.**
 - Hydraulic power unit and hydraulic service manifold. Piping
 - Real time controller and user interface application.
 - Outer Loop Controller: **Spectral Dynamics' Jaguar™**
 - Inner Loop Controller: **VZERO MADC Controller**
 - Data acquisition hardware and instrumentation (strain gauges, lvdt, accelerometers, etc.)



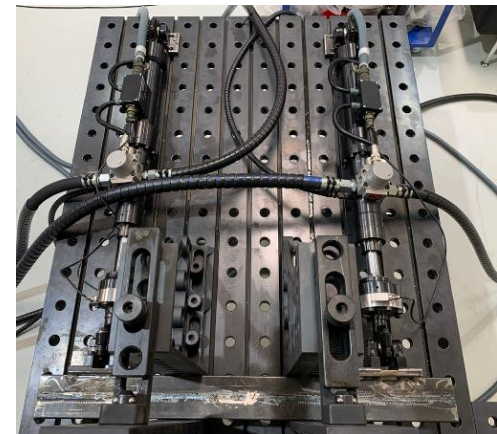
STRUCTURAL TESTING SYSTEMS: DYNAMIC TESTING SYSTEMS



STRUCTURAL TESTING SYSTEMS: DYNAMIC TESTING SYSTEMS



STRUCTURAL TESTING SYSTEMS: DYNAMIC TESTING SYSTEMS



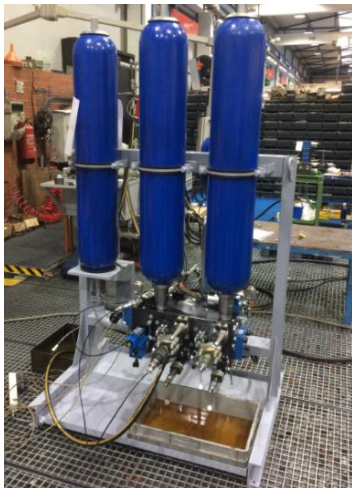
STRUCTURAL TESTING SYSTEMS: FOUR AND TWO POSTER TESTING SYSTEMS

- Applications:
 - Durability assessment
 - Ride comfort evaluation
 - Buzz, Squeak and Rattle
 - Vehicle optimization
 - End of line quality testing



STRUCTURAL TESTING SYSTEMS: FOUR AND TWO POSTER TESTING SYSTEMS

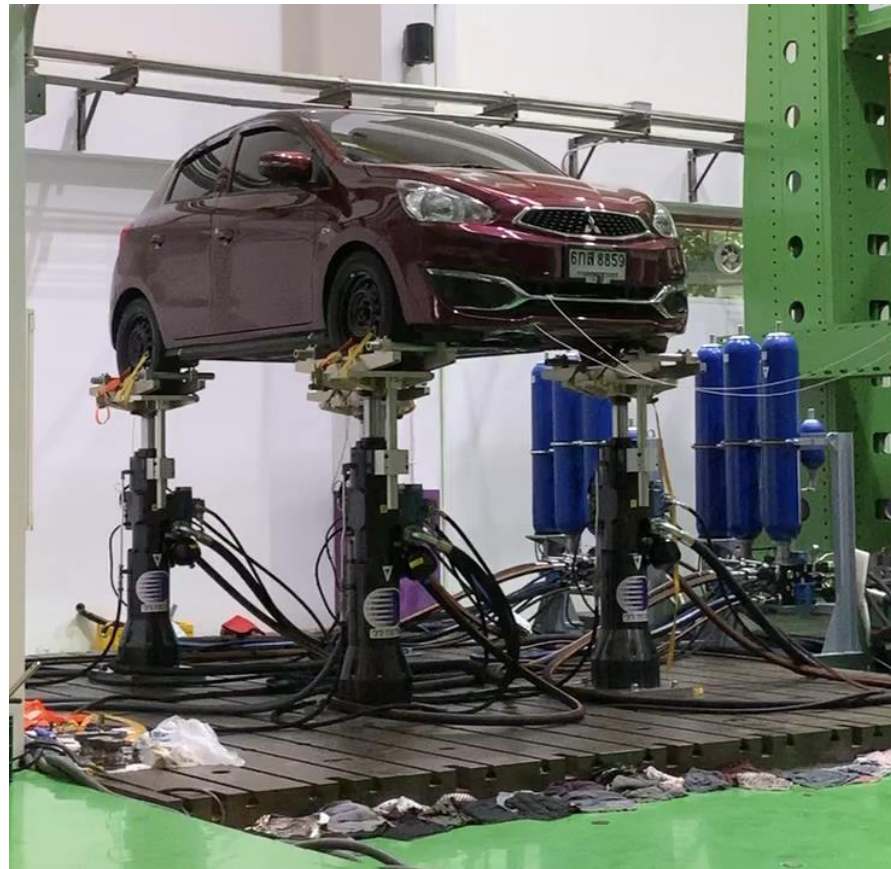
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STRUCTURAL TESTING SYSTEMS: FOUR AND TWO POSTER TESTING SYSTEMS



STRUCTURAL TESTING SYSTEMS: FOUR AND TWO POSTER TESTING SYSTEMS



STRUCTURAL TESTING SYSTEMS: FOUR AND TWO POSTER TESTING SYSTEMS



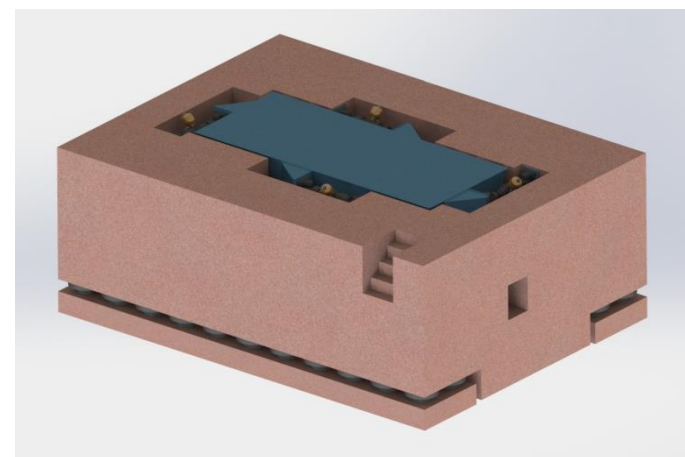
STRUCTURAL TESTING SYSTEMS: FOUR AND TWO POSTER TESTING SYSTEMS



STRUCTURAL TESTING SYSTEMS: SHAKE TABLES

▪ Technical features

- Payloads: up to 20 ton. Higher payloads on demand
- Frequency range: up to 100 Hz. Higher frequencies on demand.
- Degrees of freedom: 1 (horizontal or vertical), 2 (horizontal), 3 (translations or rotations), 6.
- Typical stroke: up to 500 mm. Higher strokes on demand
- Typical velocities: up to 2 m/s. Higher velocities on demand
- Typical accelerations: up to 5 g. Higher accelerations on demand



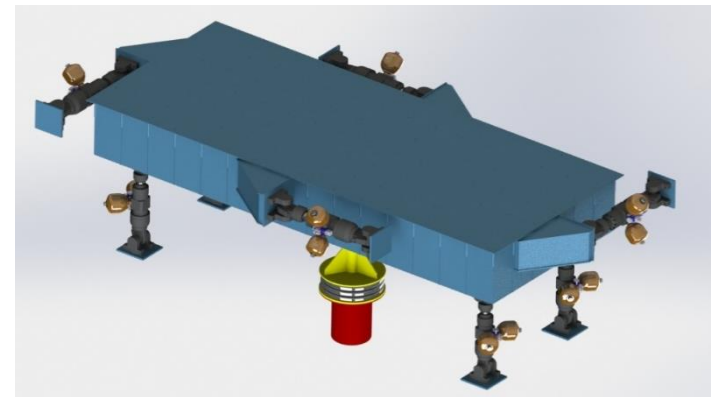
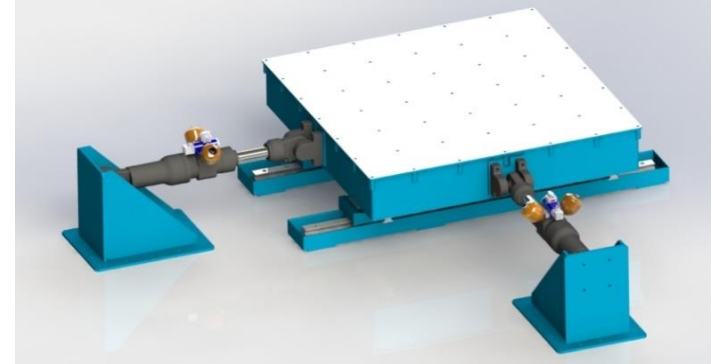
STRUCTURAL TESTING SYSTEMS: SHAKE TABLES

Scope of supply:

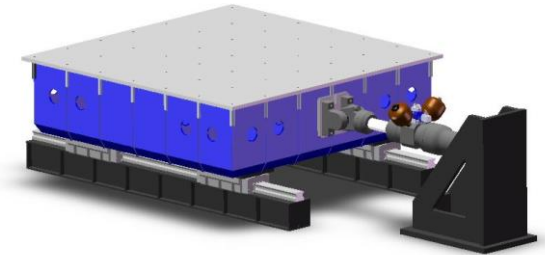
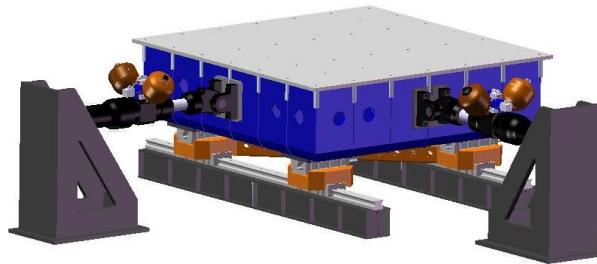
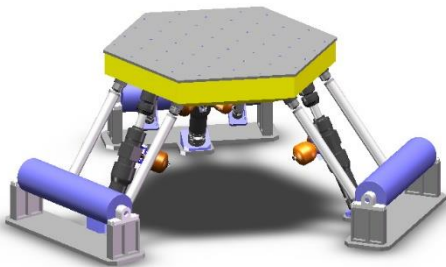
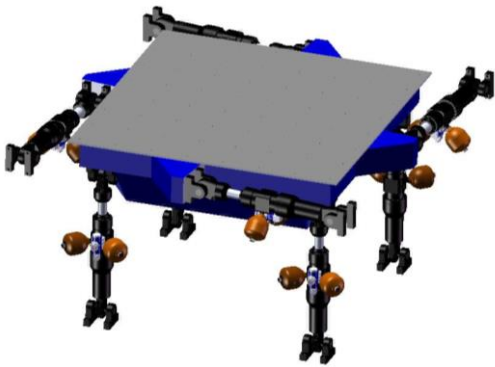
- Laboratory layout definition. Civil works detailed design: pit, retaining walls, slab, reaction mass.
- Isolation system: air-spring, spring or polymer based.
- Shake table and guidance system if required.
- Hydraulic servoactuators including displacement transducers, accelerometers and high performance servovalve. Hydrostatic or hydrodynamic bearings. Pressure and return accumulators.
- Servoactuators fixation elements: adjustable backlash swivels.
- Hydraulic power unit and hydraulic service manifold. Piping. Water cooling system. Water chiller if required
- Inner loop real time controller for actuator trajectory control and kinematic relationships solution. Advanced control algorithms.
- Outer loop real time controller: Spectral Dynamics' Jaguar™. DoF advanced control. Overall system impedance identification. Adaptive and predictive control.
- Data acquisition hardware and instrumentation: strain gauges, lvdts, accelerometers, etc.

Applications

- Dynamic testing of full or reduced scale models
- Evaluation of actual transient response of structures
- Testing of aerospace, automotive, energy or railway components or assemblies under a wide range of regulations



STRUCTURAL TESTING SYSTEMS: SHAKE TABLES



STRUCTURAL TESTING SYSTEMS: SHAKE TABLES

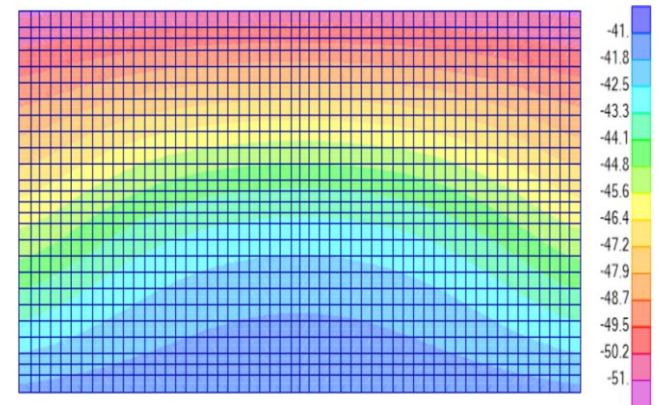
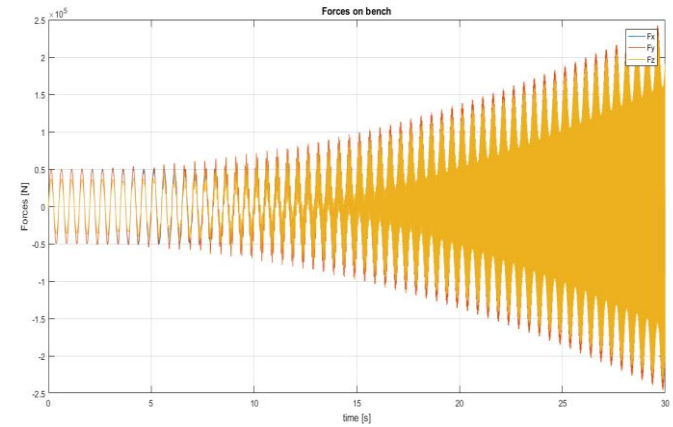
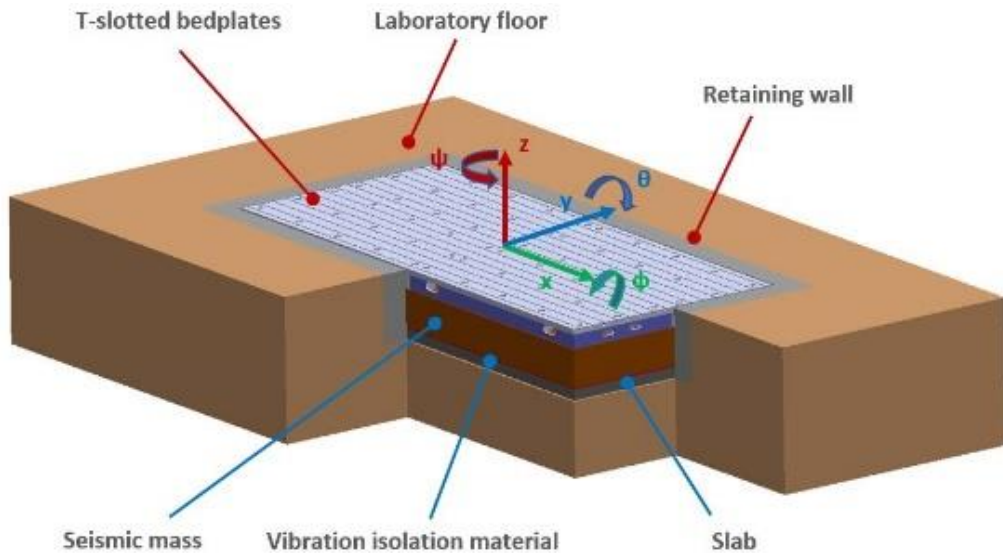




STRUCTURAL TESTING SYSTEMS: SHAKE TABLES



STRUCTURAL TESTING SYSTEMS: COMPONENT IN THE LOOP (CIL) TESTING



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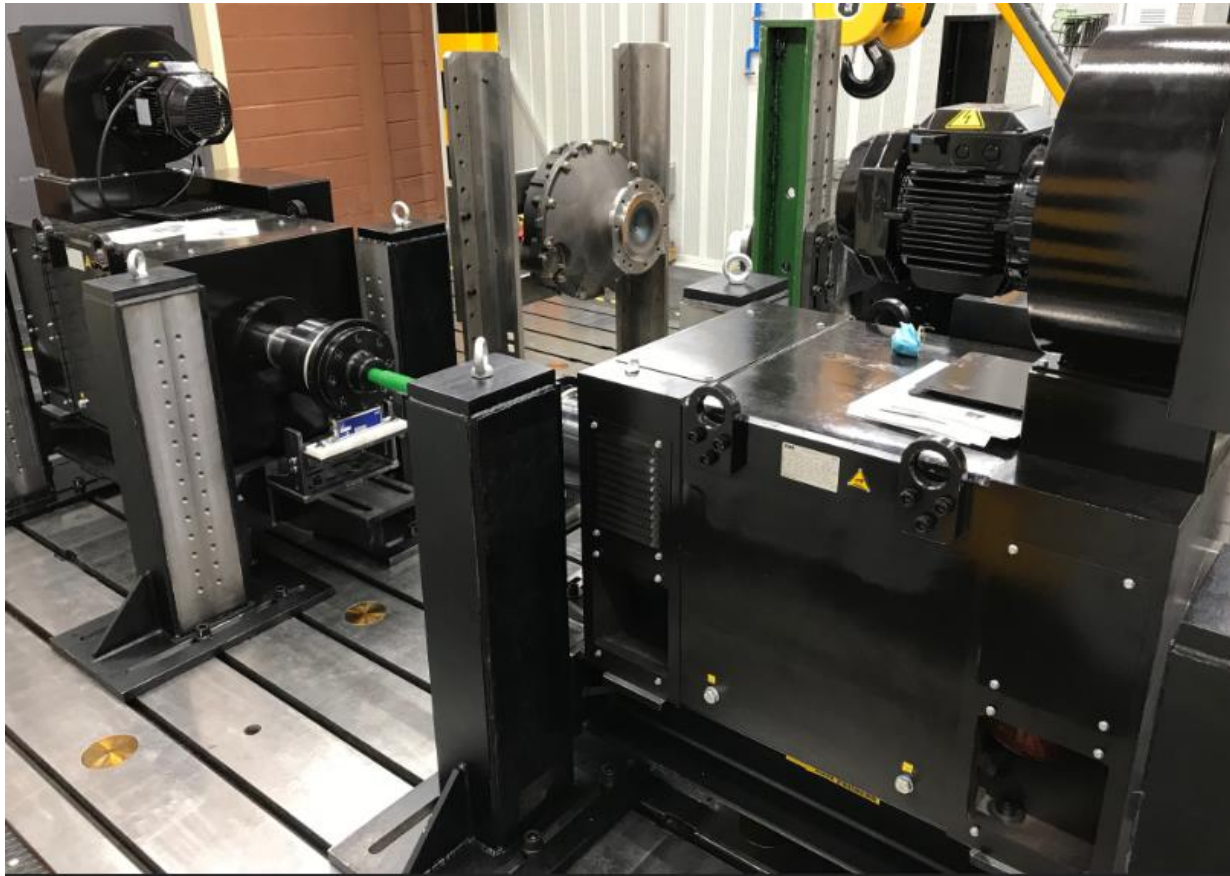
STRUCTURAL TESTING SYSTEMS: COMPONENT IN THE LOOP (CIL) TESTING



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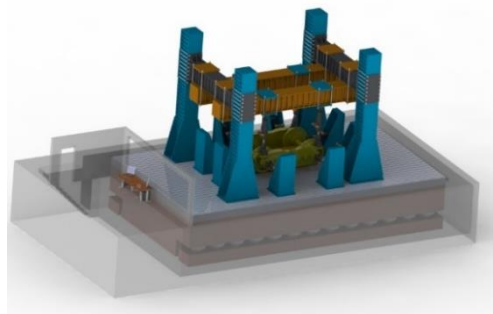


STRUCTURAL TESTING SYSTEMS: COMPONENT IN THE LOOP (CIL) TESTING



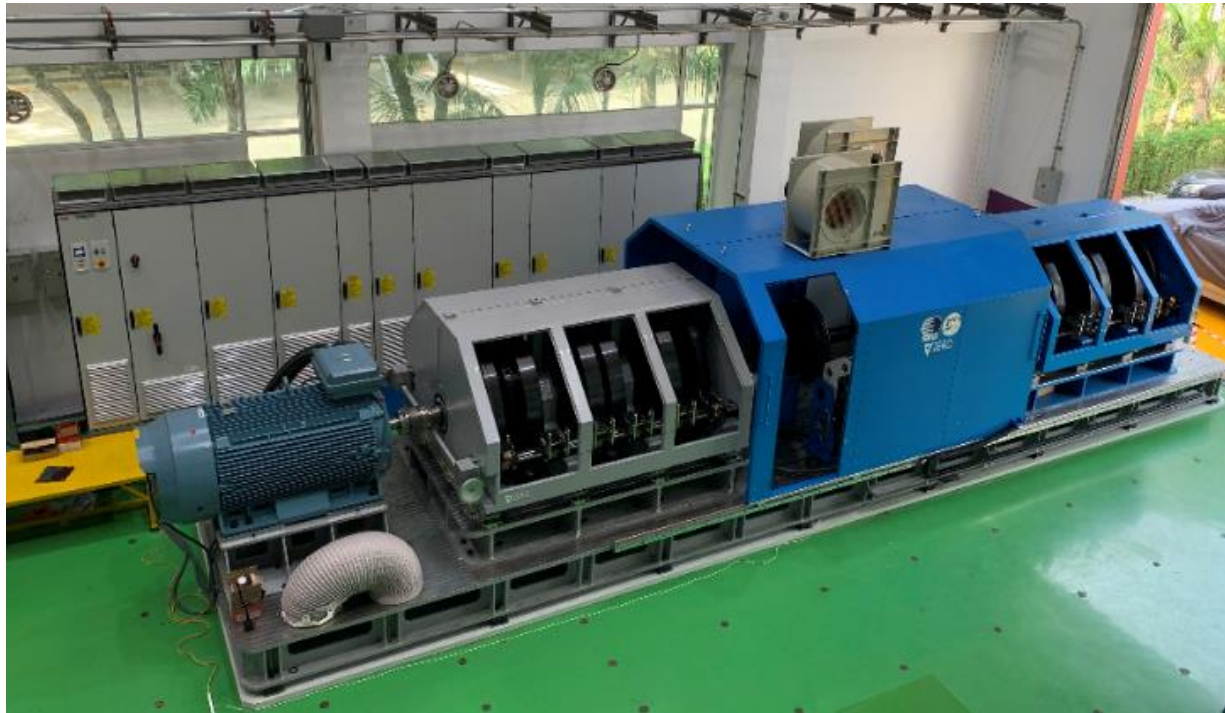
STRUCTURAL TESTING SYSTEMS: RAILWAY INDUSTRY TESTING SYSTEMS

- Railway brakes dynamometer
- Bogies dynamic testing rig
- Railway infrastructure accelerated life simulation
- Wheel loading and souplesse homologation test benches
- OCS & Pantograph Test Bench
- Railway sleepers test bench
- Bogie suspension test bench
- Turn/tilt platform test: EN 14383
- Train cars crushing: UNE-EN-12663



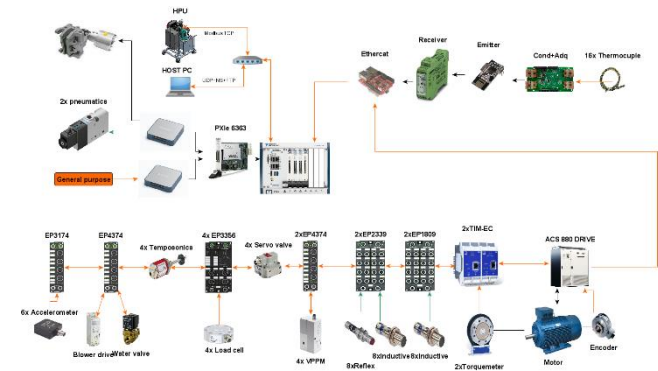
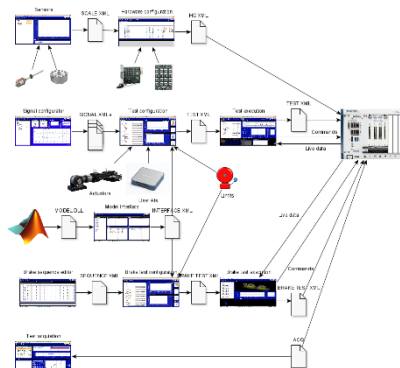
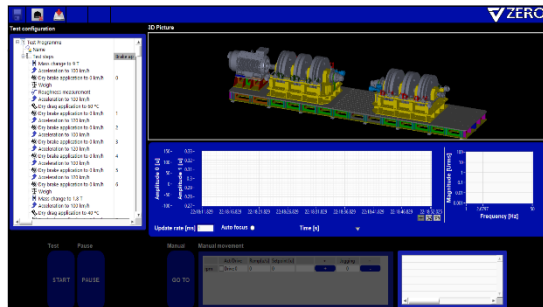
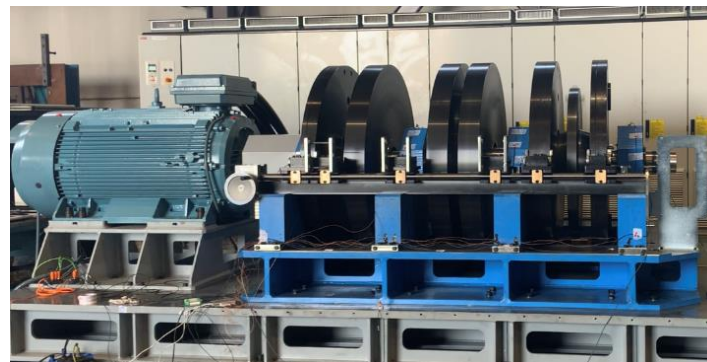
STRUCTURAL TESTING SYSTEMS: RAILWAY INDUSTRY TESTING SYSTEMS

Railway brakes dynamometer according to UIC regulations.



STRUCTURAL TESTING SYSTEMS: RAILWAY INDUSTRY TESTING SYSTEMS

Railway brakes dynamometer according to UIC regulations.



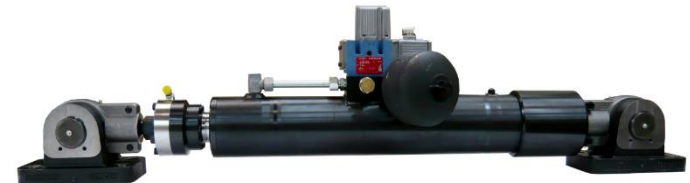
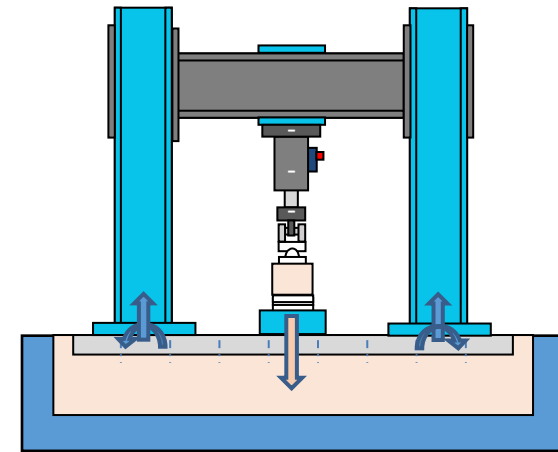
STRUCTURAL TESTING SYSTEMS: RAILWAY INDUSTRY TESTING SYSTEMS

*Accelerated railway infrastructure life
Testing system*



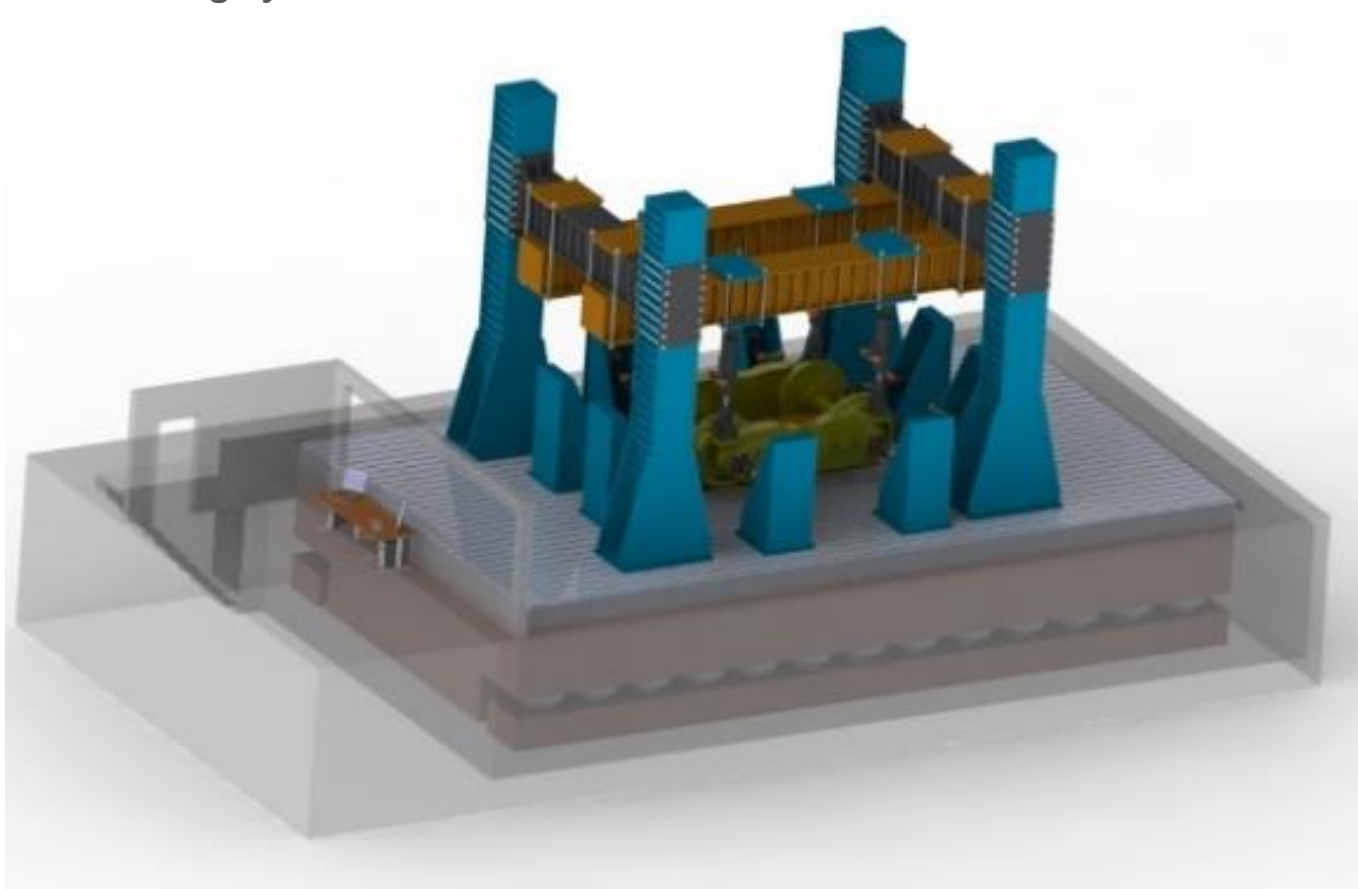
STRUCTURAL TESTING SYSTEMS: RAILWAY INDUSTRY TESTING SYSTEMS

Sleepers and fasteners testing system



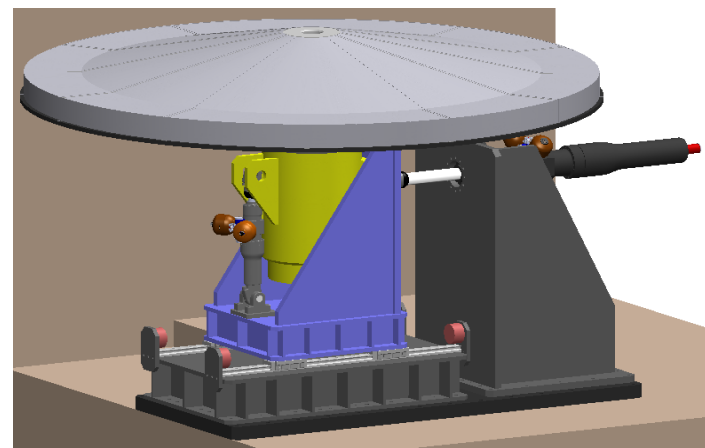
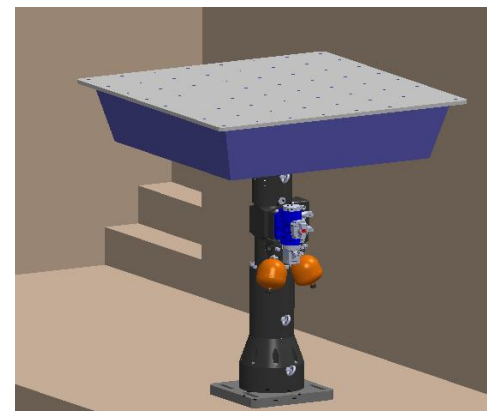
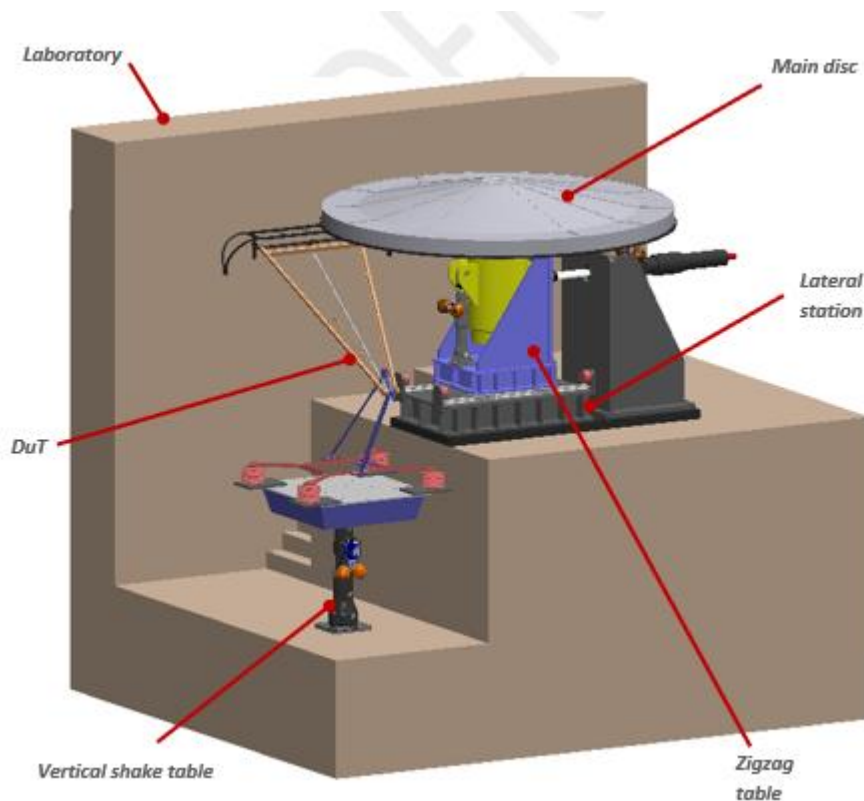
STRUCTURAL TESTING SYSTEMS: RAILWAY INDUSTRY TESTING SYSTEMS

Bogies dynamic testing system



STRUCTURAL TESTING SYSTEMS: RAILWAY INDUSTRY TESTING SYSTEMS

Overhead catenary system and pantograph testing system



STRUCTURAL TESTING SYSTEMS: ELECTRODYNAMIC SHAKERS AND VIBRATION CONTROLLERS

- Spectral Dynamics®



PIND

Particle Impact Noise Detection



Puma

Vibration Control and Analysis System for PC



Lynx

Compact Vibration Control System



jaquar

Large Scale, Powerful Workstation-based System



STRUCTURAL TESTING SYSTEMS: ELECTROMECHANICAL ACTUATION SYSTEMS

Customized test bench for turbine vacuum testing



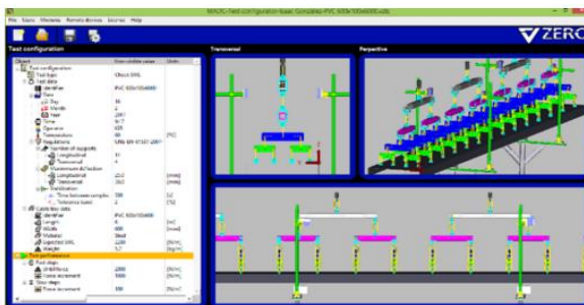
STRUCTURAL TESTING SYSTEMS: ELECTROMECHANICAL ACTUATION SYSTEMS

Cable trays and supports testing system according UNE EN 61537 and NEMA regulations.

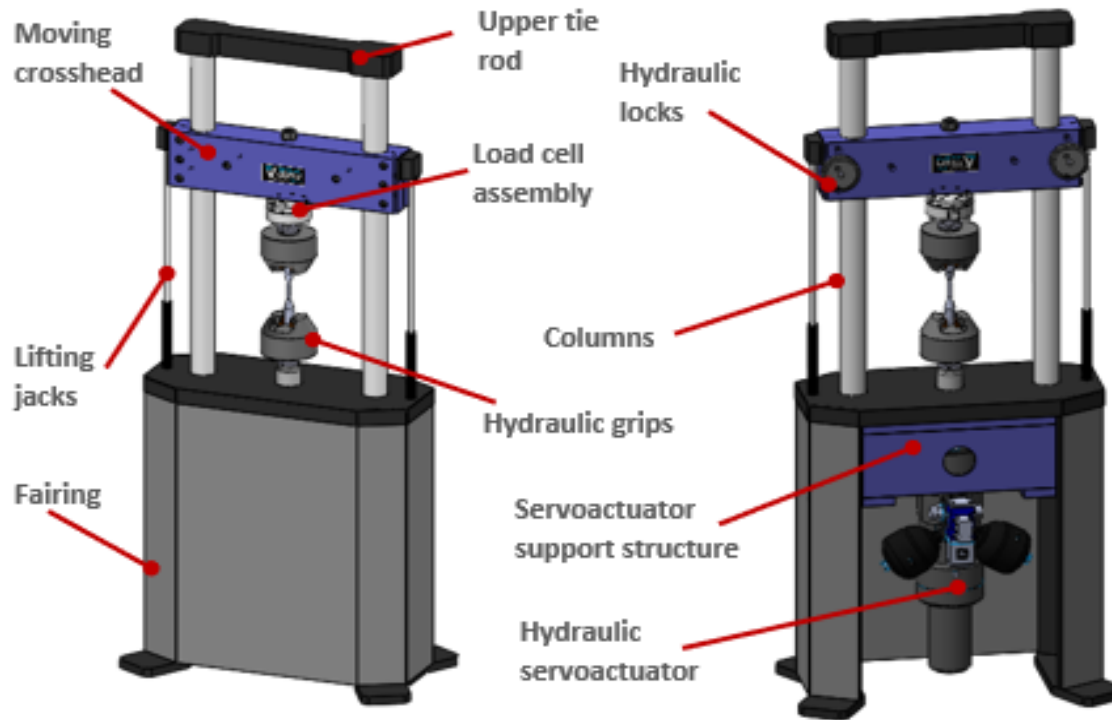


STRUCTURAL TESTING SYSTEMS: ELECTROMECHANICAL ACTUATION SYSTEMS

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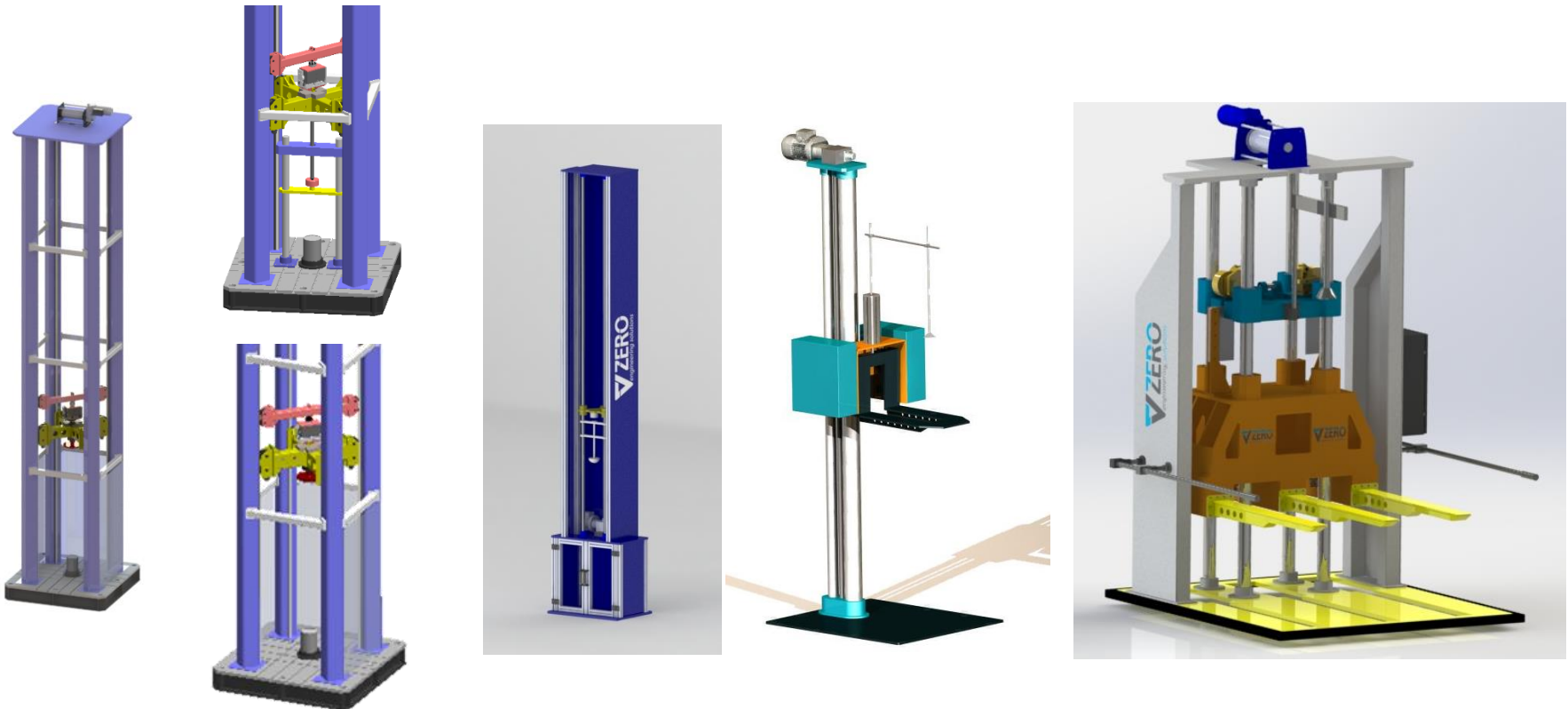


STRUCTURAL TESTING SYSTEMS: UNIVERSAL TESTING MACHINES



STRUCTURAL TESTING SYSTEMS: DROP TOWERS

- Compliant with: ISO 3127, ISO 6603, ISO 7765, EN 744, EN 1411, ASTM D 2444, ASTM D 3763, ASTM D5276, MIL 810, IS 7028-4, ISTA

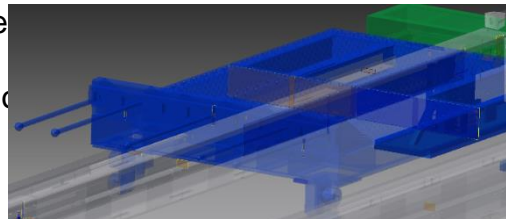
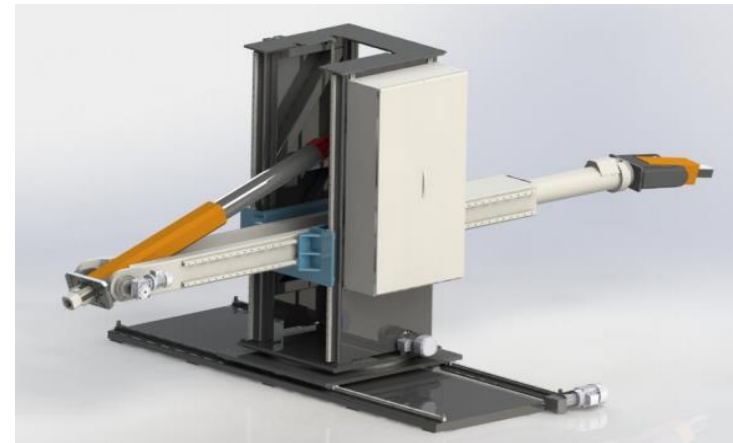
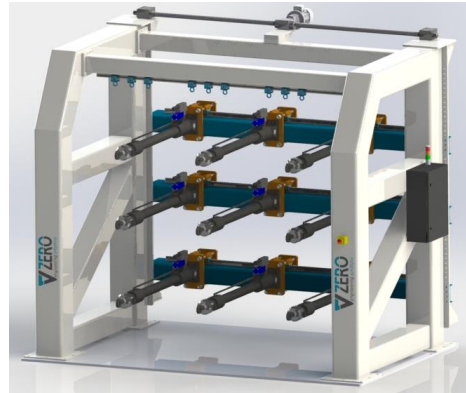


Passive Safety Testing Systems

2-PRODUCTS

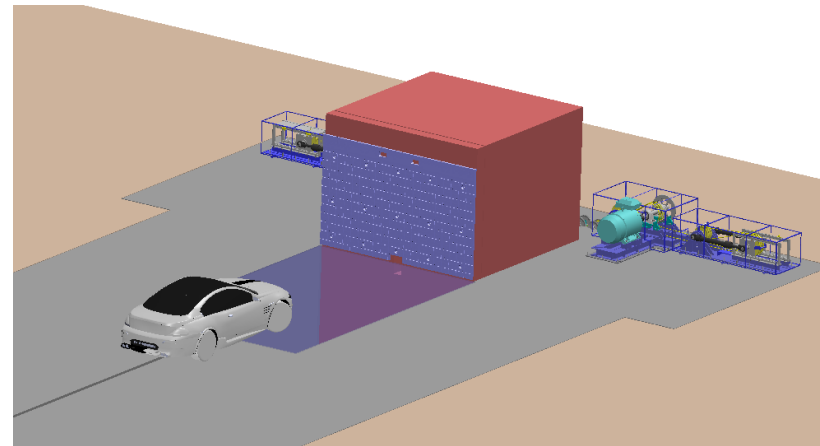
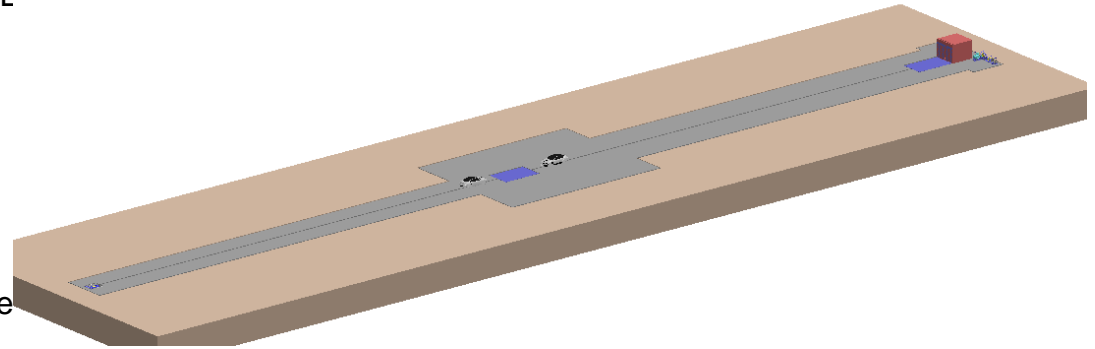
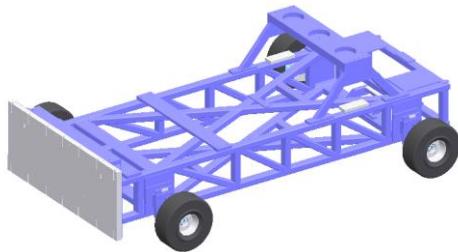
PASSIVE SAFETY TESTING SYSTEMS

- Full scale crash test facilities and components
- Crash simulation systems: acceleration and deceleration sleds
- Pedestrian anthropomorphic forms launcher
- Seat belt anchorages test bench
- Static test bench for seats and head restraints.
- Bus seats test bench (R80)
- Impact pendulums
- Fatigue testing rigs for components: i.e.; Coupling Devices (balls and bars, fifth wheel)
- Rollovers
- Roof Crush and Side Intrusion test bench
- Window retention test bench



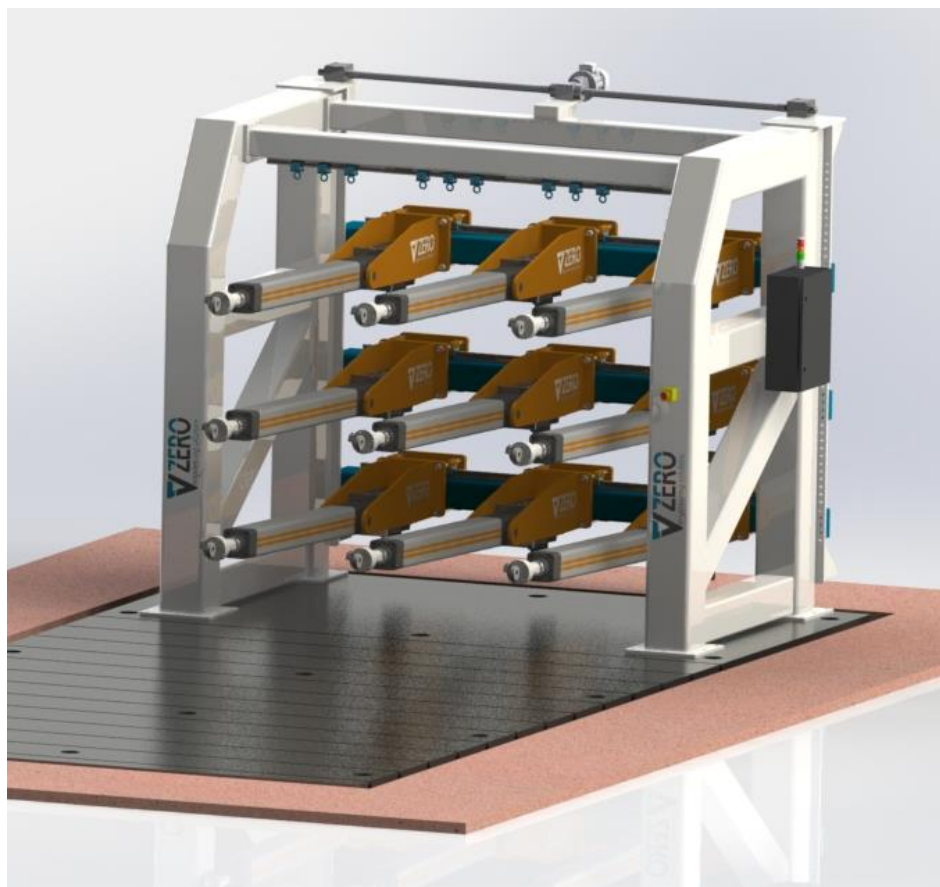
PASSIVE SAFETY TESTING SYSTEMS: FULL SCALE CRASH TESTING SYSTEMS

- Compliant with the following regulations: ECE FMVSS, EEC, GB, NCAP, IIHS, etc
- Car-to-car
- Angle tracks.
- AC servomotor propulsion
- Reduced size trolley
- Filming pits
- Moving barriers
- Frontal impact, side impact, rear impact, side pole, static rollover, dynamic rollover, etc.
- Standard features (CUSTOMIZABLE).
Maximum mass: 5t, maximum speed: 120 km/h
- On board brakes, lighting system, high speed camera system, etc.

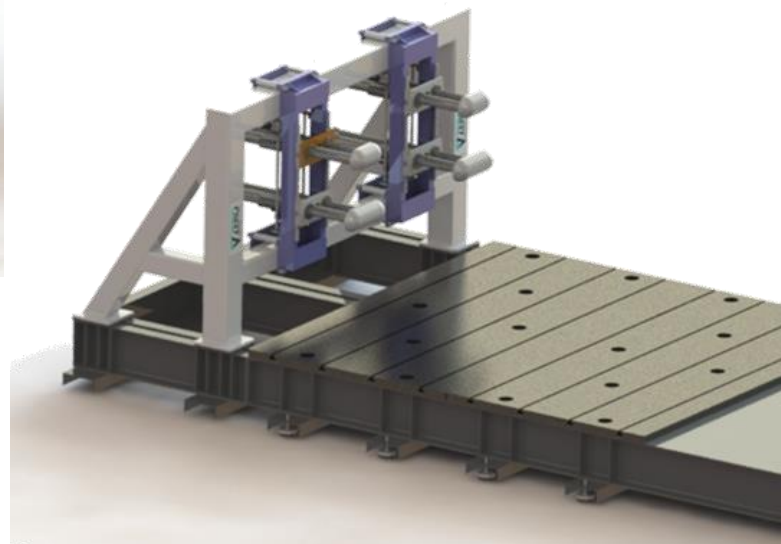
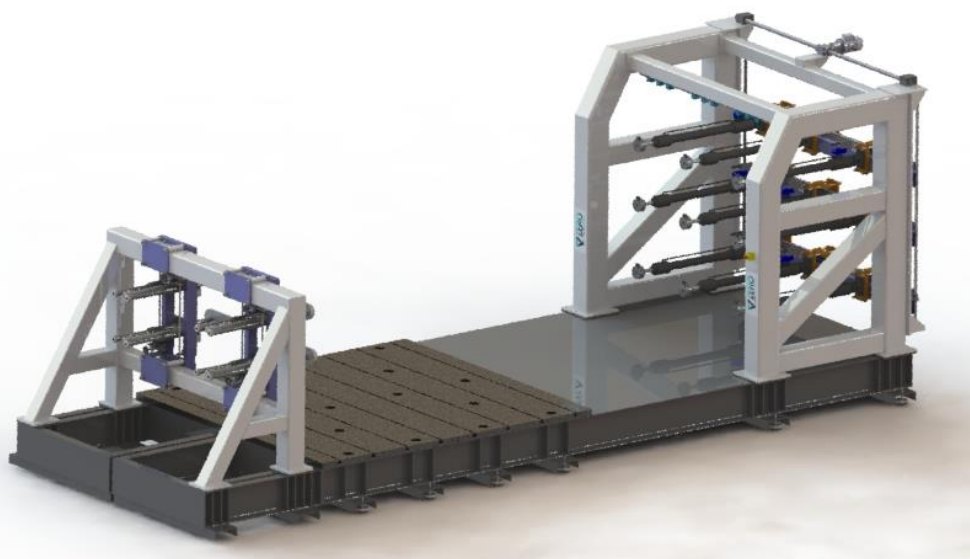


PASSIVE SAFETY TESTING SYSTEMS: SEAT BELT ANCHORAGES TESTING SYSTEM

- Compliant with the following regulations: ECE R14, FMVSS 210, FMVSS 207, EEC Dir. 76/115, GB 14167-2013 ISOFIX
- High stiffness frame.
- Optional bedplate or support structure
- Easy positioning in vertical and lateral directions
- Easy test setup
- Up to 12 servoactuators simultaneously controlled
- Electromechanical or hydraulic actuation technology
- More than 20 kN dynamic force. 1000 mm stroke
- Advanced multi-axis control system VZERO MADC®



PASSIVE SAFETY TESTING SYSTEMS: SEAT BELT ANCHORAGES TESTING SYSTEM



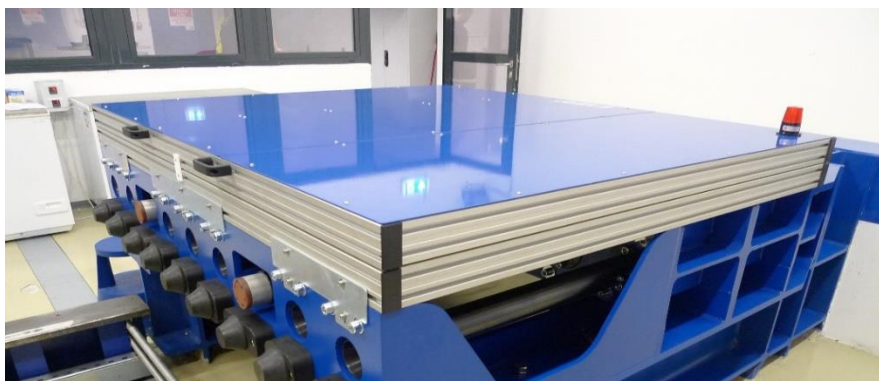
PASSIVE SAFETY TESTING SYSTEMS: SEATS AND HEAD RESTRAINTS TEST SYSTEM

- Compliant with the following regulations: UN ECE R17, R25|FMVSS 202, 202 A|GTR7
- 1, 2 or 3 simultaneous seats can be tested
- Automatic positioning
- Optional bedplate
- Electromechanical actuation
- Headform force ≥ 5 kN
- Back Moment ≥ 1 kN·m
- Advanced multiaxis control system VZERO MADC®



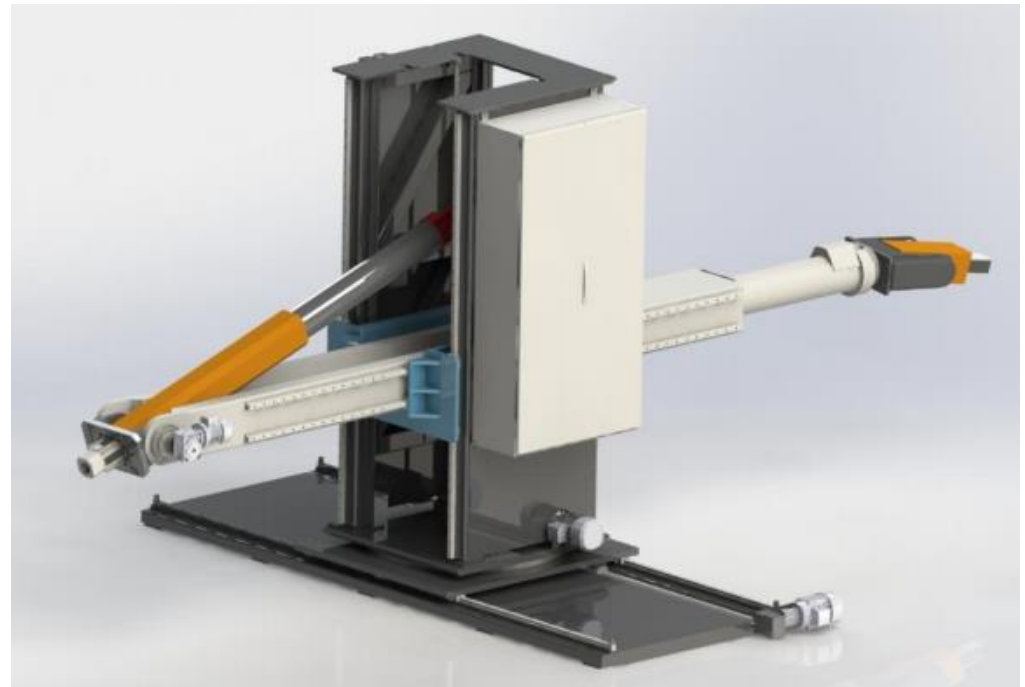
PASSIVE SAFETY TESTING SYSTEMS: CRASH SIMULATION SLEDS

- Compliant with the following regulations: ECE R16 for seat belts | ECE R17 for seats and anchorages | ECE R44 for child seats | ECE R80 for large passenger seats | USNCAP | EuroNCAP | FIA 8853/98 for safety harnesses | FIA 8854/98 for safety harnesses | FIA 8855/1999 for competition seats
- Propulsion based on Bungee cords or AC Motor
- Maximum payload 2000 kg, Maximum velocity 80 km/h, Maximum deceleration: 80 g
- Deceleration system: Polyurethane tubes | Bending bars | Hydraulic
- Acceleration sleds on demand
- Auxiliary equipment: Seats, B-Pillar, Supports | R16/ TNO dummy | Lighting system | Speed measurement device | Airbag firing box | High speed cameras | Data acquisition system



PASSIVE SAFETY TESTING SYSTEMS: UNIVERSAL LAUNCHER

- Impactors: Linear headform (UN ECE R12). Bodyblock (UN ECE R12). Child and adult headform (JARI/GTR 9/JNCAP/J-MLIT/TRIA 63-2004/EU directive 78/2009 and EuroNCAP). Adult headform, upper legform and lower legform (EEVC WG 17). Ejection mitigation (FMVSS 226), FMH201U (FMVSS 201). Pendulum (UN ECE R21). Knee
- Automatic positioning
- Optional bedplate
- Propulsion system based on linear motors
- Closed loop control of propulsion speed.
- Laser speed measurement device
- Lighting and high speed cameras
- Impactor calibration rigs



Components

HYDRAULIC SERVOACTUATORS

- Dynamic and static servoactuators
- Rotary actuators
- Loads up to 1 MN. Others on demand.
- Strokes up to 500 mm. Others on demand.
- Velocities up to 5 m/s. Others on demand.
- Integrated displacement sensor and load cell (other instrumentation on demand)
- **High performance servovalves (MOOG)**
- Bearings technology: **polymeric** (static), **hydrodynamic and hydrostatic** (dynamic)
- Fixation to reaction structure and specimen: standard spherical swivels and clevis bracket (static) / adjustable backlash swivels for dynamic applications, intermediate trunnion, pedestal, etc.
- **Custom servoactuators**



HYDRAULIC POWER UNITS AND SERVICE MANIFOLDS

- HPU
 - Working pressure up to 250 bar
 - Flow rates up to 3600 lpm (others on demand)
 - Scalable architecture
 - OFF-LOW-HIGH pressure feature
 - Pressure side filtering 3um
 - Independent cooling and filtering circuit
 - Oil-water/Oil-air heat exchangers
 - Water chillers
 - Power and control cabinet
 - Real time controller. Intelligent consumption regulation
 - Remote operation
- HSM
 - Up to 8 independent actuators (more actuators on demand)
 - Scalable architecture
 - Pressure and return accumulation
 - Filter
 - OFF-LOW-HIGH pressure feature



VZERO MADC MULTIAXIS ADVANCED SERVOCONTROLLER

General features

- Multipurpose MIMO control for virtually any type of axis
- Low latency, deterministic control loop: 4-15 kHz
- Real time operating system
- PXI /FPGA hardware architecture
- Built in signal conditioning. Customizable IOs
- 2, 4, 6, 8, 12 simultaneously controlled axes
- Multistation feature

Advanced features

- Inverse and direct kinematics solution in real time for complex testing systems.
- System linearization by model inversion
- State space control schemes
- Three variable control
- Predictive PID loops (PPID)
- Hierarchic loops (HL)
- Adaptive Control of Oscillatory Waveforms (ACOW)



Alliance
Partner

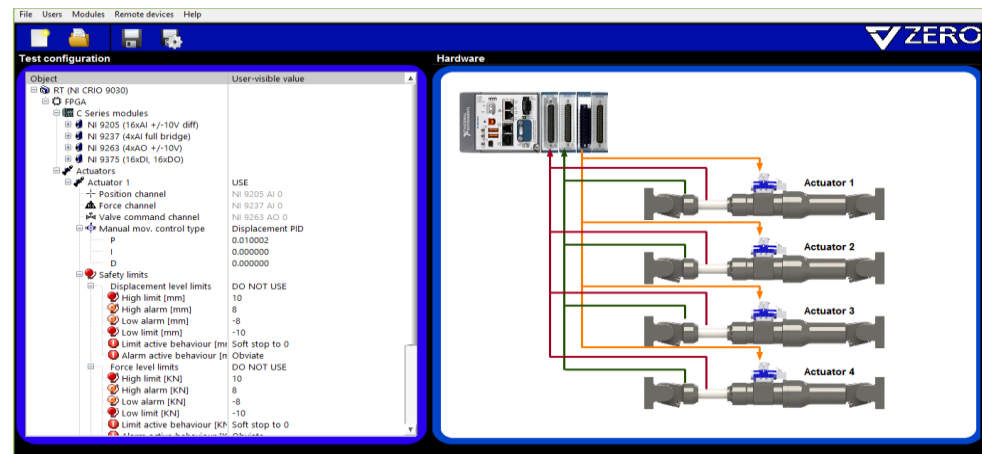
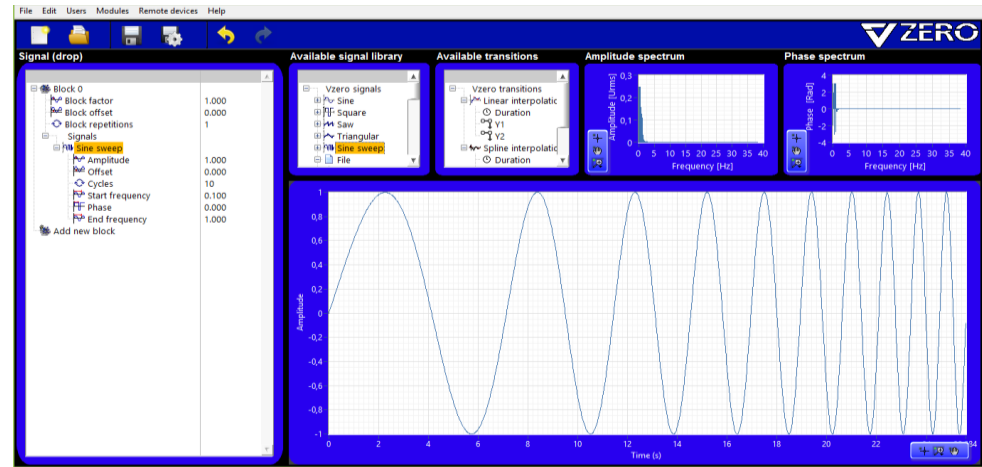


NATIONAL INSTRUMENTS
LabVIEW™

VZERO MADC MULTIAXIS ADVANCED SERVOCONTROLLER

- User friendly user interface based on differentiated software modules to easily perform, in a step by step fashion:

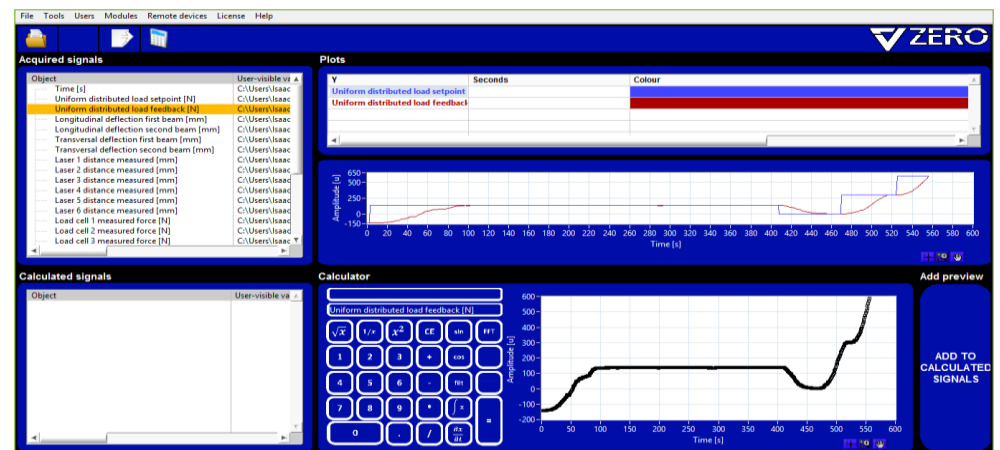
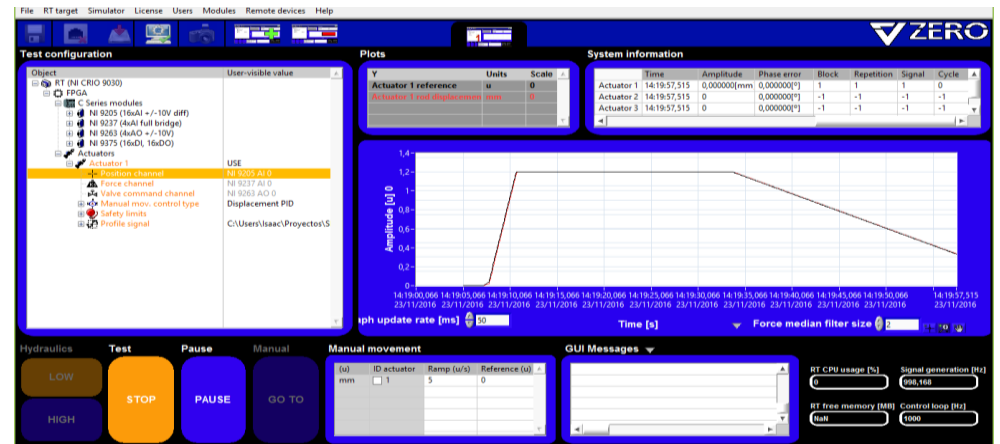
- Reference profiles definition: wide variety of available waveforms.
- Test definition: references assignation, control philosophy, data saving
- Test execution: load, start, pause, resume, abort and finish.
- Test data review: calculations between channels, reporting.



VZERO MADC MULTIAXIS ADVANCED SERVOCONTROLLER

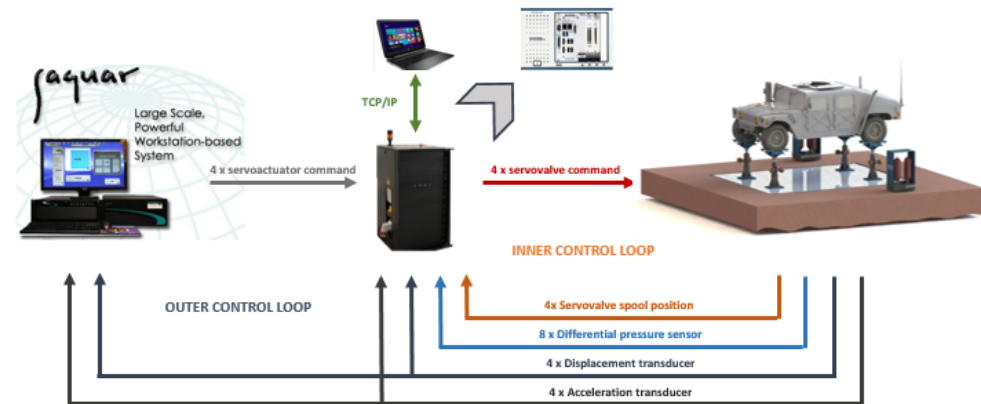
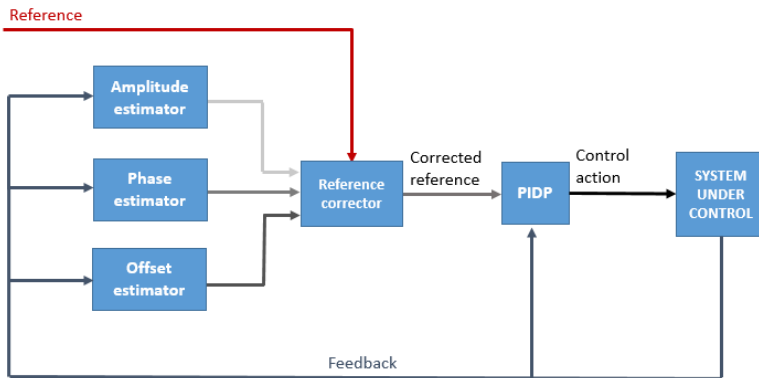
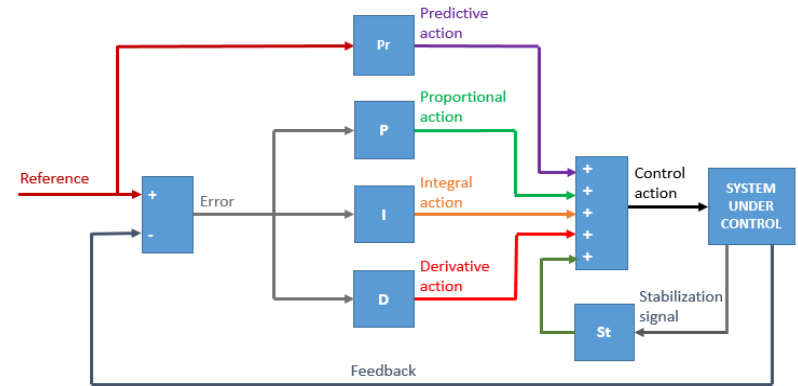
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VZERO MADC MULTIAXIS ADVANCED SERVOCONTROLLER

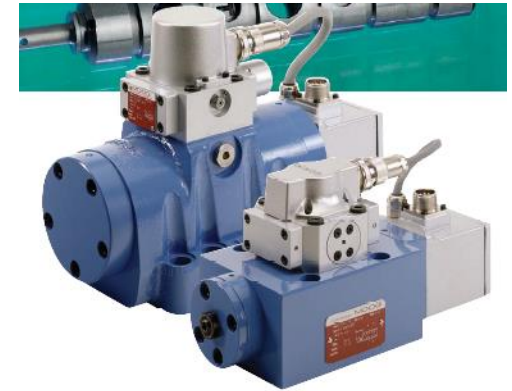
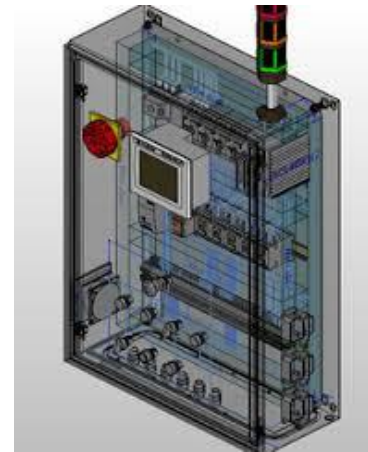
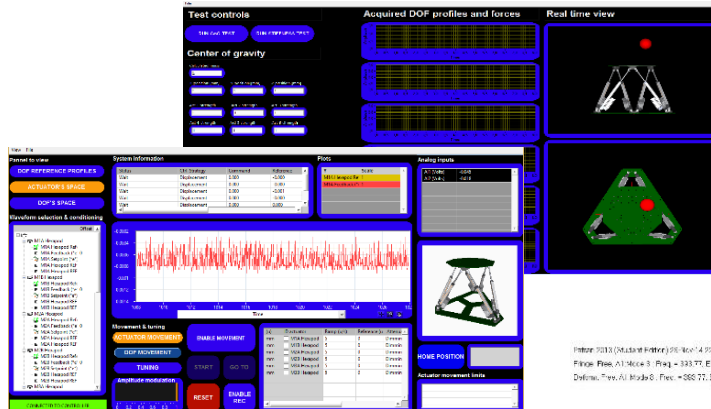
- Wide arsenal of available control algorithms to face the most demanding testing requirements.
- Easy integration with third party hardware for more complex control architectures



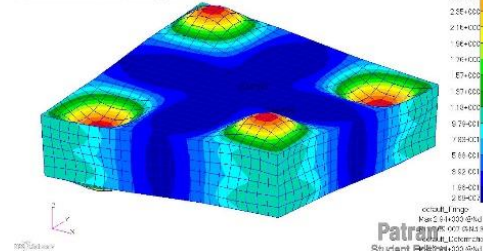
1. Introduction
2. Products
3. **Services**
4. Customers
5. Contact information

SERVICES

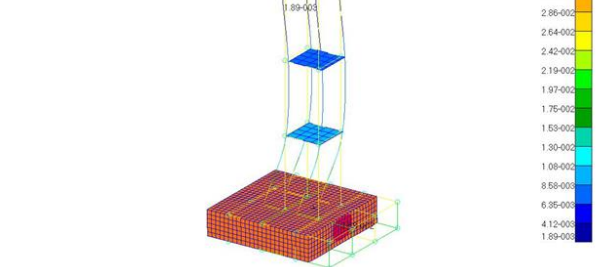
- Mechanical engineering
- Electrical and instrumentation engineering
- Hydraulic and pneumatic engineering
- Software and control engineering



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SYSTEMS MODERNIZATION AND MAINTENANCE: SEVERE IMPACT SYSTEM



SYSTEMS MODERNIZATION AND MAINTENANCE: UNIVERSAL LAUNCHER



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DE VALÈNCIA**

CEDEX

**CENTRO DE ESTUDIOS
Y EXPERIMENTACIÓN
DE OBRAS PÚBLICAS**



**INSTITUTO DE MICROELECTRÓNICA DE MADRID
(CENTRO NACIONAL DE MICROELECTRÓNICA)**



INGENIERIA Y SISTEMAS, S.A.



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