

CUSTOMERS: More than 40 customers support us. They have worked with us :

Big enterprises

- Adhex Tech Tapes
- ALCOA Lista Norway
- Analistas Financieros Internacionales (AFI)
- Babcock International Group
- CIE Galfor
- Coremain
- Elkem Technology
- Endesa Generación
- Eramet Norway Kvinesdal
- Ferroatlántica
- Ferropem
- Inditex
- Regasificadora del Noroeste (Reganosa)
- Repsol
- Robert Bosch GmbH
- Saint Gobain Ceramic Materials
- Televes
- TSK Electrónica y Electricidad

SMEs

- Balidea
- BRDM Consultores Asociados
- Consultores en Excelencia e Innovación Estratégica (INOVA)
- Detegasa
- Ecomanagement Technology (EcoMT)
- Estaños y Soldaduras Senra
- Fundiciones Rey
- Magallanes Renovables
- Resitec
- Sidernaval, Equipos Siderúrgicos
- Silicio Ferrosolar
- VICUS Desarrollos Tecnológicos (VICUSdt)

Universities, foundations, consortiums, research centers and technology centers

- Centro de Tecnología Repsol (CTR Repsol)
- Centro Superior de Estudios de la Defensa Nacional (CESEDEN)
- Centro Tecnológico de Eficiencia y Sostenibilidad Energética (Energylab)
- Fundación Pública Gallega Centro de Supercomputación de Galicia (CESGA)
- IK4-Ikerlan
- Instituto Español de Estudios Estratégicos
- Norwegian University of Science and Technology (NTNU)
- Oxford Center for Industrial and Applied Mathematics (OCIAM)
- Teknova
- TicSalut, Tecnología Innovació i Salut
- Universidade da Coruña (UDC)
- Universidade de Santiago de Compostela (USC)
- University of Agder (UiA)

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Page: ITMATI (Instituto Tecnológico de Matemática Industrial)
Group: ITMATI - Interacción Matemática Industria



Universidade de Vigo

Innovative Solutions from mathematical technology

- Product and solutions development
- Technology Consulting
- High level scientific advisory
- R&D&i collaborative projects
- Development of customized software
- Training on demand

ITMATI = INNOVATION + TECHNOLOGY + MATHEMATICS + INDUSTRY

Technological Institute for Industrial Mathematics (ITMATI)

ITMATI is a technological institute in Industrial Mathematics which aims to provide solutions to business, industries and governments to support

the **innovation** and **improve the competitiveness** in the productive sector.

ITMATI has **experts** in the field of Applied Mathematics, Statistics and Operations Research with extensive **experience** and recognized **expertise** in developing **solutions** for the business world.

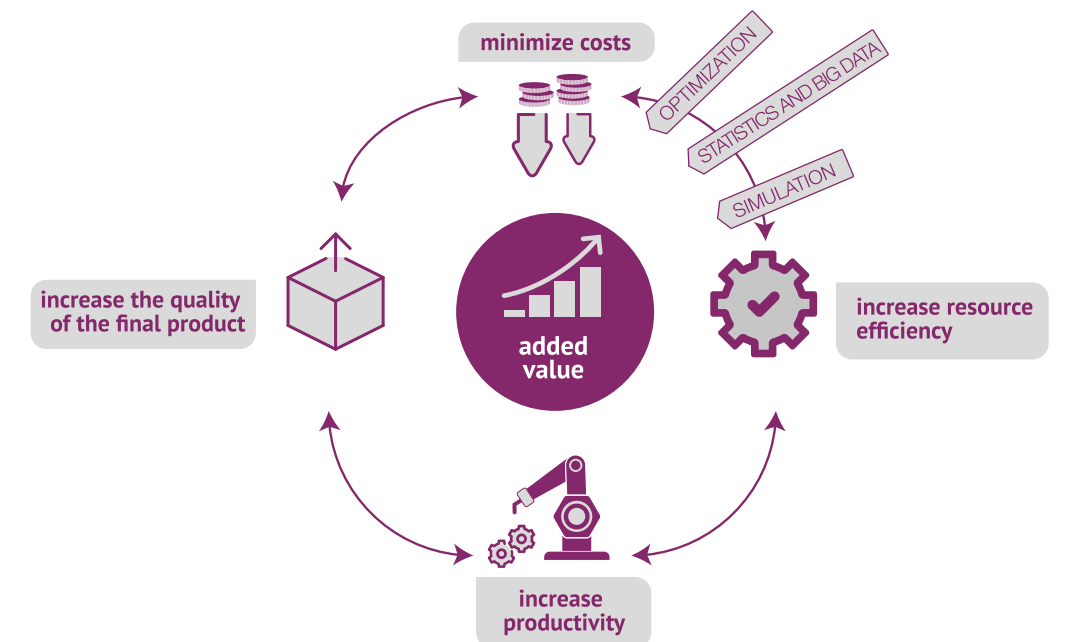
ITMATI staff and its extensive network of partners provide

scientific excellence **experience in developing solutions for the productive system** to give a **personalized service** to its customers.

Legally constituted as a consortium from the three Galician universities (Universidade da Coruña, Universidade de Santiago de Compostela and Universidade de Vigo), its main aim is to boost mathematical technology transfer and to become an international reference technological research center.

Mathematics are at the base the most of scientific and technological developments. From their transfer of technological solutions, Mathematics contribute decisively to the creation of **economic value** in many sectors.

In addition to the transverse lines of work which address a wide range of solutions in areas such as **quality control, processes simulation** and **planning or management of resources**, ITMATI performs a continuous effort of specialization with a constant orientation to:



Transfer Areas

Numerical Simulation (CAD/CAE)

What they are

Techniques for modelling, simulation and optimization of devices, products or industrial processes, finance or business in the following kinds of application:

- ┆ Mechanical or Structural.
- ┆ Thermal and Thermodynamic.
- ┆ Electronic and/or Electromagnetic.
- ┆ Fluids: gases, liquids.
- ┆ Chemical kinetics.
- ┆ Acoustic or Vibroacoustic.
- ┆ Environmental.
- ┆ Fluid-structure interaction.
- ┆ Multiphysics.
- ┆ Finance.

What they are used for

- ┆ Analysis, Simulation and prediction of the devices or processes.
- ┆ Reduced costs and development times for new products.
- ┆ Processes optimization.

Application areas

- ┆ Development of machinery, part design, plans, drawings, images or graphics.
- ┆ Thermal studies, structures calculus, manufacturing processes, combustion processes, environmental simulations.

Statistics and Big Data

What they are

Technologies developed in this area fall under the categories of statistical inference, biostatistics, geostatistics, sampling and resampling techniques, time series, non-parametric inference, categorical data, censored and/or truncated data, forecasting and multivariate analysis, inter alia.

What they are used for

- ┆ Production process and stock control.
- ┆ Quality control and reliability.
- ┆ Financial and risk analysis.
- ┆ Exploitation of internal information. Data mining.

Application areas

- ┆ Financial modelling.
- ┆ Environmental and energy modelling.
- ┆ Development of health statistics.

Optimization

What they are

Techniques that combine numerical simulation, statistics and operational research for products and processes optimization, and in general, designing tools that help in the decision making process.

Application areas

- ┆ Modelling and optimization of gas transmission networks.
- ┆ Incorporation of uncertainty that exists concerning prices, demands and quality of raw materials and products in the decision-making processes relating to production planning in industrial plants.
- ┆ Development of expert systems for monitoring and managing resources dedicated to fight fires as well as to assist decision-makers.
- ┆ Harvester route planning in agricultural cooperatives.

What they are used for

- ┆ Product and stock optimization.
- ┆ Optimization of resources and its location.
- ┆ Optimization of industrial and business processes.
- ┆ Route planning.
- ┆ Work planning.
- ┆ Strategy, logistics and planning.
- ┆ Services location.
- ┆ Optimal decision-making.

Sectors that support our extensive experience



Aeronautics, automotive and maritime

- ┆ Multiphysics coupled simulations that include thermomechanical, thermo-hydrodynamic, aerodynamic, thermoelectric and thermomagnetic phenomena.
- ┆ Numerical simulation of industrial equipment and processes, namely induction furnaces, air flows in spray booths, heat exchangers, solidification processes of metal parts, radial and axial bearings, bearings for marine propulsion, automotive components and electronic devices.
- ┆ Calculation of aerodynamic coefficients.
- ┆ Active and passive noise control.
- ┆ Design of steering wheels, sails and underwater hulls.
- ┆ Use and training on free and commercial CFD software in this sector.
- ┆ Estimate of the vessels energy demand during docking.
- ┆ Vessels reliability.
- ┆ Image-based obstacle identification to create automatic alerts in case of potential danger of collision.
- ┆ Real-time decision-making to optimize ground and aerial means during firefighting.
- ┆ Numerical verification of ISO standards.



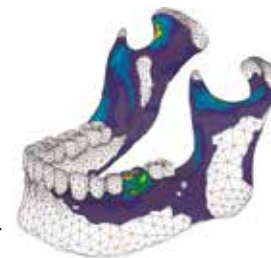
Agriculture and food industry

- ┆ Analysis and optimization sterilization procedures of packaged food.
- ┆ Determination of the height and thickness of vegetation by using LIDAR images.
- ┆ Efficacy of phytosanitary products. Epidemiological risk maps.
- ┆ Food quality and preservation.
- ┆ Agricultural machinery logistics.
- ┆ Optimization of packaging.
- ┆ Study of the properties of materials for their manufacture and quality control.
- ┆ Optimization of food freezing and thawing processes.



Biomedicine and health

- ┆ Analysis and design of experiments and clinical trials.
- ┆ Biostatistics.
- ┆ Comprehensive control of medical variables and prediction of their impact.
- ┆ Reliability and security of treatments. Epidemiology. Mortality and survival tables.
- ┆ Surgery waiting lists. On-call roster schedules. Patient multi-appointments.
- ┆ Numerical simulation in biomechanical issues, such as bone formation, fractures, dental implants and orthodontic brackets.



Stresses in a human jaw



Economics and finance

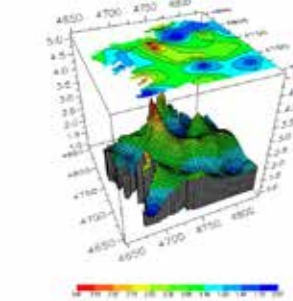
- ┆ Analysis and prediction of interest rates. Quantitative finance.
- ┆ Development internal measurement, management and control models.
- ┆ Incorporation of the market uncertainty in the decision-making processes.
- ┆ Measurement of financial and operational risk.
- ┆ Stochastic modelling of the accident rate.
- ┆ Markets studies and quality of services.
- ┆ Valuation and optimization of flows in portfolios with assets and liabilities and financial products.



Energy and environment

- ┆ Development of advanced technologies in firefighting.
- ┆ Pollution control. Impact estimation and emissions reduction.
- ┆ Noise control and acoustic impact assessment.
- ┆ Development of expert systems for monitoring and managing firefighting resources.
- ┆ Computational Fluid Dynamics (CFD). Heat transfer, chemical kinetics, hydrodynamics and combustion processes.

- ┆ Renewable energies: wind energy, solar energy and biomass. Wind forecasting maps.
- ┆ Market studies on energy trading.
- ┆ Identification of kinetic parameters in energy processes.
- ┆ Impact of works in rivers and coastal areas.
- ┆ Use and training on free and commercial CFD software in this sector.
- ┆ Modelling and simulation of complete-mixture digesters.
- ┆ Statistical modelling for the characterization of the energy-demand operational profile of docked vessels.
- ┆ Modelling and simulation of pulverized-coal oxycombustion with flames.
- ┆ Modelling and simulation of forest fires.
- ┆ Statistical models for the energy and environmental sectors.
- ┆ Design and load optimization for energy storage systems.
- ┆ Combustion optimization in metallurgical furnaces.
- ┆ Optimization of facilities and design of new generation plants.
- ┆ Optimization of energy-distribution networks.
- ┆ Optimization of the design of floating platforms which generate energy from marine currents.
- ┆ Optimization of process plants under uncertainty.
- ┆ Breakdown prediction in energy-production processes and devices.
- ┆ Air contamination forecasting in cities using systems which monitor pollutant emission from a focal point.
- ┆ Forecasting the risk of events affecting air conditioning systems.
- ┆ Simulation of air and water quality.
- ┆ Simulation of combustion in coal and oil-fired furnaces.
- ┆ Simulation of electric machines.
- ┆ Simulation of dynamics models for the integration of suspended particles.
- ┆ Simulation of electric batteries charging and discharging processes.
- ┆ Simulation of processes in energy installations. Energy efficiency.
- ┆ Simulation of hydrological systems.
- ┆ Simulation of pollutant propagation and dispersion.
- ┆ Simulation and optimization of gas transmission networks.
- ┆ Numerical simulation of pollutant dispersion within rivers, estuaries and oceans.



Average concentration levels of Nickel in moss



Defence

- ┆ Calculation of the reliability of submarines.
- ┆ Definition, validation and representation of indicators of reliability, availability and maintainability in railroad infrastructures.
- ┆ Development of advanced algorithms related to critical emergency missions with both manned and unmanned aerial vehicles in cooperative flight.
- ┆ Design and diagnosis, by means of statistical models, of the impurity content in aviation fuel.
- ┆ Study of pyrotechnic substances combustion.
- ┆ Orbit predictions and navigation satellite clocks.
- ┆ Numerical simulation of large ice masses.
- ┆ Numerical simulation of structural strength and rollover resistance tests of heavy vehicles with heavy loads.



Information technology and telecommunications

- ┆ Development of customized mathematical-technology software applications in the areas of numerical simulation, statistics, big data and optimization.
- ┆ Development of data protection and electronic security systems.
- ┆ Operation of databases: Business Intelligence.
- ┆ Optimization of non-conventional hardware.
- ┆ Optimization and parallelization of algorithms.
- ┆ GPU and FPGA programming.
- ┆ Optical fibre simulation.
- ┆ Simulation and design of electromagnetic and electronic devices.



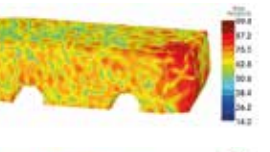
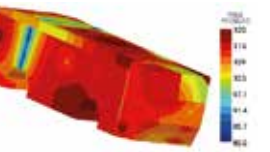
Logistics and transport

- ┆ Development of expert systems for characterizing the territory.
- ┆ Development of expert systems for enhancing the efficiency of unloading operations during firefighting.
- ┆ Development of expert systems for decision-making in order to control the cooperation between manned and unmanned aircrafts.
- ┆ Study of the incidence and impact of promotional periods on the demand regarding different types of articles.
- ┆ Management and distribution of goods.
- ┆ Optimization of the logistical flow of components for wind industry. *Stresses in a human jaw*.
- ┆ Optimization of transport planning.
- ┆ Planning of loading and unloading arrangements.
- ┆ Route planning and optimization.
- ┆ Simulation of new transport technologies.



Materials and construction

- ┆ Mechanical, structural, thermal, thermodynamic and acoustic calculations.
- ┆ Numerical characterization of the behaviour of materials.
- ┆ Use and training of free and commercial CFD software for structure calculation and electromagnetism in this sector.
- ┆ Mathematical modelling of scaling processes in metallurgical production.
- ┆ Multiphysics simulation: thermomechanical, thermoelectric, electromagnetic, magneto-hydrodynamic or fluid-structure interaction.
- ┆ Simulation of combustion and electrical behaviour of arc furnaces used in the metallurgy sector.
- ┆ Simulation of purification of materials and industrial grinding.
- ┆ Simulation of fire resistance of buildings.
- ┆ Simulation of the resistance of buildings to climatic impacts.
- ┆ Simulation of strength of materials.
- ┆ Simulation of bridge resistance during load tests.
- ┆ Simulation of metal and ferro-alloy solidification.
- ┆ Process simulation in micro-nano alumina.
- ┆ Simulation of thermal and acoustics insulation on housing facilities.
- ┆ Thermoelectric simulation of aluminium electrolytic cells.
- ┆ Thermo-electromagnetic simulation of metallurgical electrodes.
- ┆ Thermomechanical simulation of ventilated facades.
- ┆ Thermal stresses in structures subject to low temperatures.
- ┆ Structure vibrations.



Simulation of sound pressure on a bus



Tourism and services

- ┆ People's habits analysis.
- ┆ Demographic change analysis.
- ┆ Survey design, development, analysis and filtering process.
- ┆ Studies on labour insertion.
- ┆ Statistical study on the behaviour of tourist networks.