


COMPANY PROFILE





our solutions,
YOUR SUCCESS

GENERAL ENGINEERING SOLUTIONS IS A MULTI-DISCIPLINARY CONSULTANCY AND THE LEADING PROVIDER OF HIGHLY SPECIALISED SOLUTIONS IN THE ENGINEERING COMPUTATION SECTOR

The company was established in 2008 as a design and computation business. The company's principal objective, defined in its corporate strategy, is to continue developing its activity as the provider of advanced analyses and to strengthen its leading position in the industry within Poland and other European markets. One of the key objectives of the company's long-term strategy is the continued development of innovative solutions that meet the highest European quality standards.

The use of advanced design tools (CAD) and state-of-the-art numerical analyses tools (CAE, CFD) together with the provision of a high-quality service helps us to deliver on our business objectives in line with our strategy. The projects we undertake are mainly R&D projects for the power-engineering, aviation, railway and shipbuilding industries.

With modern technical facilities combined with best practices and experienced personnel, we are able to accept and successfully complete even the most advanced projects. We offer state-of-the-art solutions that meet stringent quality standards applicable in, for example, the aviation or power-engineering sectors.

The expertise and experience demonstrated by our specialists enable us to provide our Customers with solutions that make their products more competitive, reliable and at reduced manufacturing costs. With financial stability, we are able to continue investing large amounts of money in the latest technologies and to continue improving the qualifications of our personnel. General Engineering Solutions offers a wide range of solutions in response to even the most challenging problems in the contemporary world.

OUR MISSION

Our mission is to continuously develop our expertise in the area of numerical analyses, both structural analyses and fluid mechanics. We work to ensure that, by combining innovation with the highest quality standards and continuous improvement of our team's qualifications, we can deliver solutions that fully satisfy our Customers' needs.

Building and maintaining positive relations with our partners and the community is our priority. We wish to be fully trusted by our Customers and our Employees, as it is our Customers and Employees that we rely on for our future growth.

WE ARE A TEAM OF HIGHLY-QUALIFIED SPECIALISTS COMMITTED TO DELIVERING TOP-QUALITY SOLUTIONS THAT MAKE OUR CUSTOMERS' PRODUCTS MORE COMPETITIVE

Every day we work to maintain the highest level of our personnel's competence through regular training, organizational tests and the implementation of proven human resource management methods. The members of our team have gained their experience while working on many projects and designing solutions for international corporations as leaders in their industries, including MAN Diesel&Turbo, Alstom Power, Delphi, EKES, and Sitec Group. Our success to date, confirmed by many solutions developed for international Customers, is proof of our potential and determination in our efforts to deliver on our strategic objectives and to ensure effective teamwork.

We are working continuously to improve the quality of our services and to improve our knowledge and increase our professional qualifications. Based on our considerable design experience and extensive intellectual resources, we believe that we are well prepared to successfully respond to the growing requirements and expectations of the developing market. We do our best to ensure that our Customers can contact us with any questions they may have. Our personnel are ready to help with their knowledge, experience and friendly service.

LOCATION



General Engineering Solutions is based within the Pomeranian Science and Technology Park (PPNT) in Gdynia, Poland. In response to Customers' expectations and to facilitate business processes, technology transfers and technology implementation, our focus is effective development of our business in our industry. General Engineering Solutions membership of PPNT is proof of the company's affiliation with prestigious international organizations that group together innovation-promoting centers worldwide, such as IASP (International Association of Science Parks), which is the world's largest network of institutions that support innovation in business. This gives us access to specialist R&D resources, testing laboratories, an extensive database and technological expertise, which makes us more competitive in the market.

OUR SERVICES

The variety of our services allows us to offer solutions best suited to the most rigorous requirements of our Customers. We make efforts to ensure that our services and solutions are ahead of global trends.

BY CHOOSING US, OUR CUSTOMERS ARE ABLE TO ACHIEVE THEIR BUSINESS GOALS, WHILE REDUCING RISKS.

Thanks to our knowledge of the standards and requirements applicable in our industry, we are able to perform material strength, thermal steady state and transient analyses, material fatigue life prediction, as well as many other advanced analyses suited to the needs of our Clients. Our Customers are offered also the most innovative solutions in vibration, acoustics and advanced fluid mechanics analyses (CFD).

Since its early days, General Engineering Solutions has specialized in computations for gas turbines, both industrial and aviation, as well as computations for the shipbuilding and railway industries.

The range of services offered by GES includes:

thermal analyses for steady state and transient • strength and fatigue analyses with LCF and HCF life cycle determination • nonlinear issues (contact phenomena; plastic deformation; creep; HDPE and similar material creep analyses; hyperplasticity analyses; viscoelasticity and viscoplasticity analyses) • harmonic and modal analyses • acoustics • fluid and gas mechanics • optimization of structures in terms of strength and function.

We provide our design services not only to the aviation, power engineering, railway and shipbuilding industries, but also to a broadly defined consumer sector. All our designs are based on current trends in design and the principle that the designed structures should be optimized in terms of utility and costs. This is ensured through the use of carefully selected materials and structural parameters.

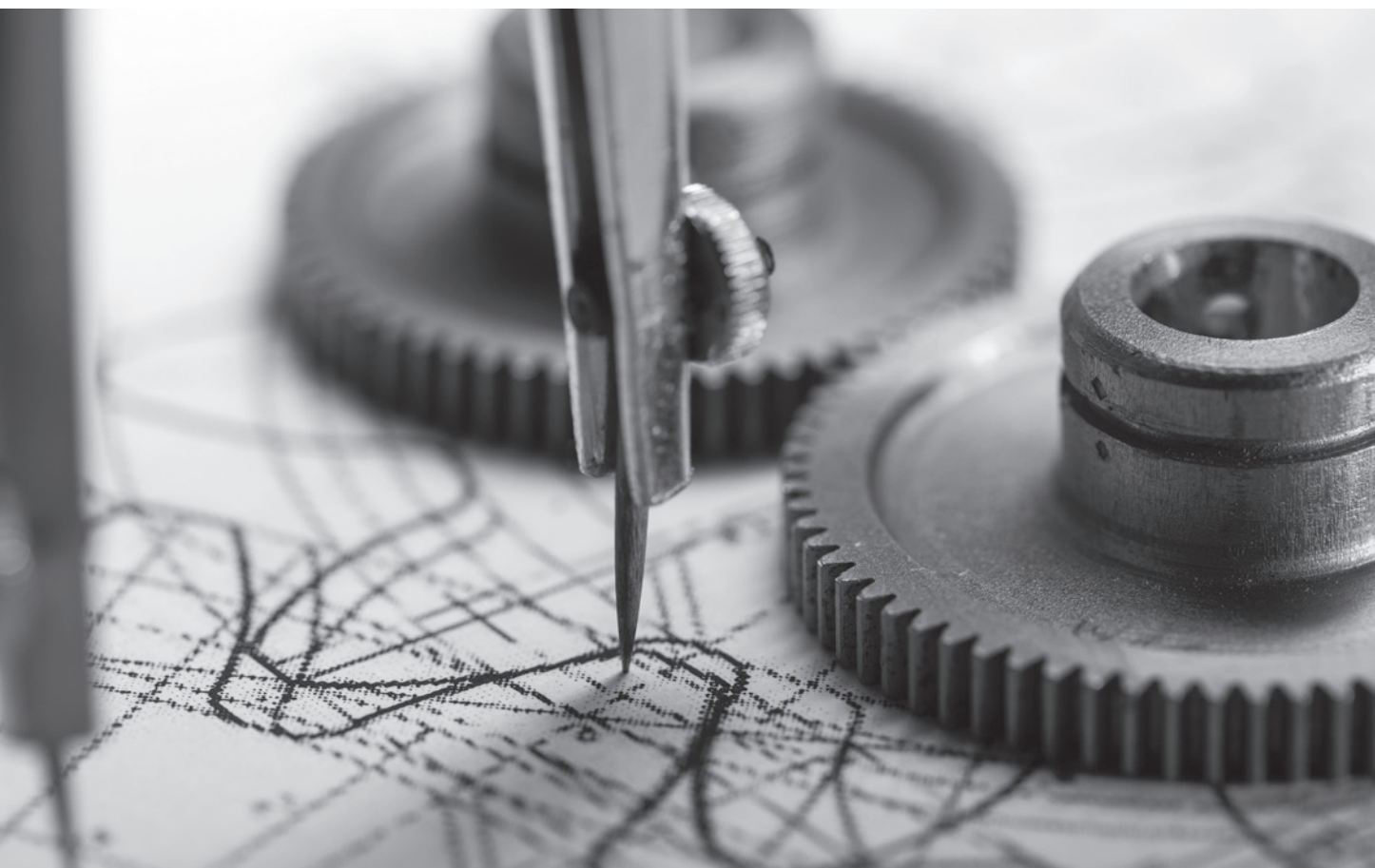
Out of respect for our customers, we offer:

innovative solutions • professional knowledge • top quality standards • advanced software • competitive prices.

DEDICATED SERVICES

For the satisfaction of our Customers, we are flexible to Customer requirements and work to ensure the highest quality Customer service. General Engineering Solutions delivers comprehensive solutions dedicated to different industries.

OUR SOLUTIONS OFFER TOP-QUALITY AND EFFECTIVE METHODS.



24H TROUBLE SHOOTING SERVICE

In early 2013, in response to our Customers' expectations, we launched a special Computation Department to respond to our Customers' maintenance problems. The idea of the new unit is to provide solutions to problems as soon as possible by services 24 hours a day.

TURBOMACHINERY INDUSTRY



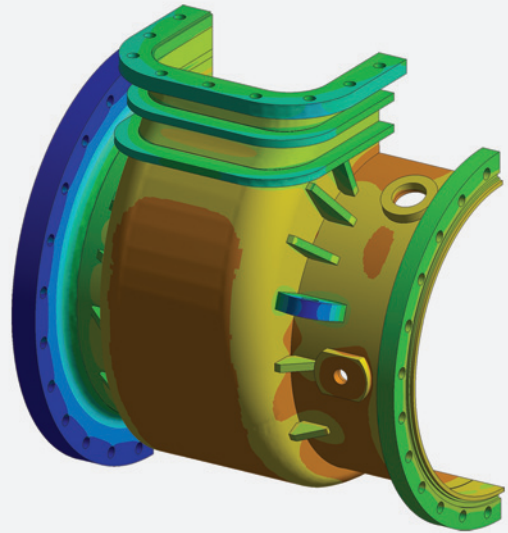
TURBOMACHINERY INDUSTRY

Since its early days, General Engineering Solutions has been specialising in numerical computation for the turbomachinery industry. Our services in this area include strength, thermal and fatigue analyses as well as advanced flow computation. The comprehensive engineering solutions delivered by General Engineering Solutions are suited to the individual needs of the Customer. This approach covers all the stages of working on a project: from component analysis, through re-designing, production and testing, to analysis and project management. We cooperate with associations that have considerable experience in the key technological areas. We offer access to specialized production through regular contact with our partners and contractors.

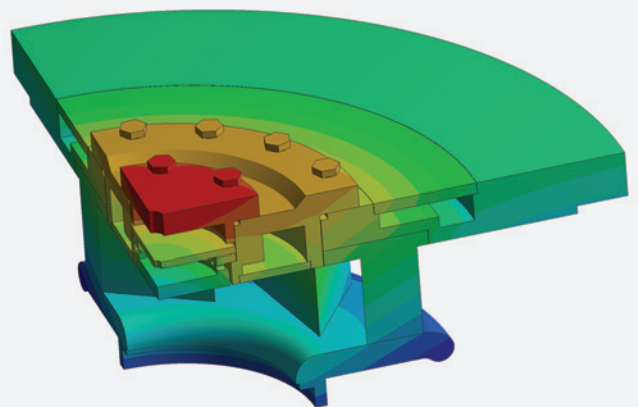
We undertake projects in all areas of gas turbine engineering, from basic tests and analyses, through design, to analyses of combustion chambers. If necessary, our engineers are available to work directly at the Customer's offices. This enhances the Customer's communication with our team and helps us to respond to the Customer's needs faster. Small dedicated teams are able to resolve the Customer's problems quickly.

We guarantee the security of our services by using and accepting confidentiality and non-disclosure agreements.

In our daily work, we perform computations for gas and steam turbine components, for both stationary and rotational low- and high-pressure sections. Below are examples of our past projects and dedicated analyses performed for Customers in the turbomachinery industry.



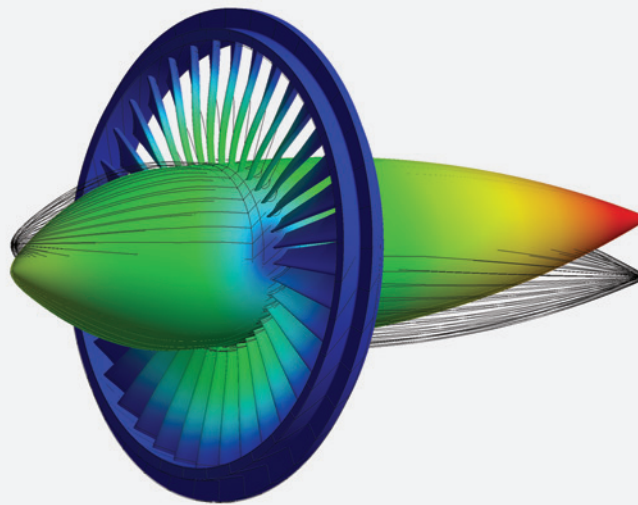
*The industrial gas turbine burner can total displacement distribution.
THM 1304 MAN Diesel&Turbo SE.*



*The industrial gas turbine head top burners
can axial displacement distribution.*

FEA SPECIALIZATION

- steady-state and transient strength analyses. The most important projects include:
 - strength analysis of the blades in a section of a high-pressure GT
 - strength analysis of a compressor shaft
 - strength analysis of the disks in a high-pressure GT section
 - strength analysis of a combustion chamber and a transition duct
- steady-state and transient thermal analyses
- the effect of thermal stress on structures
- harmonic analyses
- modal analyses of blades and complete blade rings, taking into account thermal stress, the centrifugal force and the forces from the working medium (pre-stress modal analysis) – defining typical forms of deformation and resonance frequencies (Dispersion, Campbell, Goodman diagrams)
- plastic deformation analyses
- high-temperature creep analyses
- analyses of thermal and mechanical deformation between individual components (clearance analysis)
- analyses of flange to flange contact



Pre-stress cyclic symmetry modal analysis of the prototype axial wind turbine rotor.

- analyses of bolt connections to ensure proper contact
- optimization of structures in terms of stress reduction and material selection

Our services also include computations for rotors in both axle fans and centrifugal fans, as well as for pump rotors and casings. We also offer computations for pressurized tanks in accordance with the standards of AMSE (American Society for Testing and Materials).

OTHER SERVICES FOR TURBOMACHINERY

COMBUSTION CHAMBERS

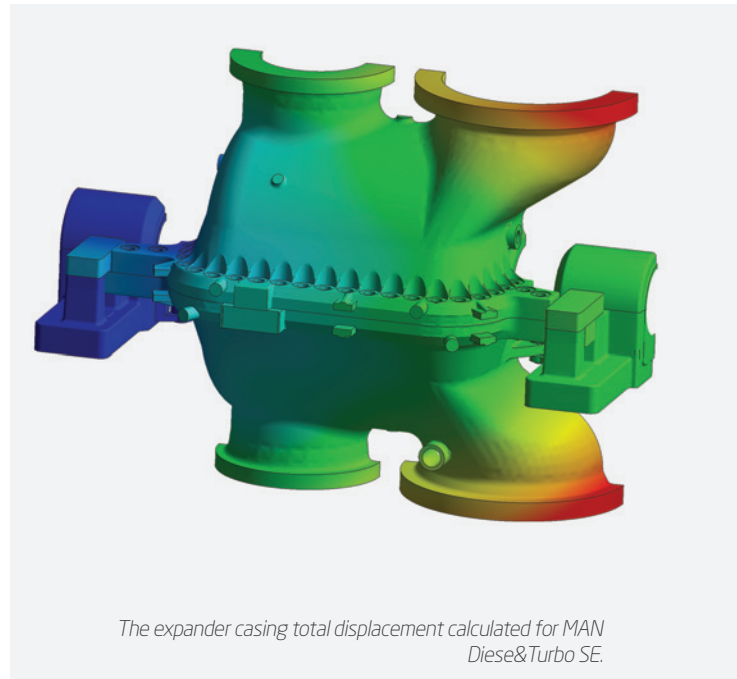
- low emissions combustor design - dual fuel
- bio-fuel burner design, High H₂ and CO content fuels
- redesign/retrofit low emissions burner
- GT transition duct redesign for life extension
- auditing of combustor development
- multi-fuel nozzle system design for syngas, diesel, LPG operation
- high pressure rig testing - validating Design of Experiment techniques
- fatigue and life assessment
- steady-state and transient strength analyses
- steady-state and transient CFD flow analyses, taking into account chemical processes and heat exchange optimization of structures to ensure the maximum lifetimes of components
- optimization and adaptation of systems for the use of alternative fuels
- optimization of materials.

PROJECT MANAGEMENT

- project management to cover the control of the engineering work
- liaison with manufacturing
- 6-sigma approach to problem definition and solving.

INSTRUMENTATION & CONTROLS

- turnkey solutions tailored to specific needs
- monitoring systems
- robust, reliable control systems for long term use (thousands of hours)
- strain gauges
- emissions probes
- specialty temperature probes
- optical probes (spectrometers & fast acting flame detectors)
- high temperature & pressure endoscopes
- vibration monitoring/diagnostics and flow instability detection.



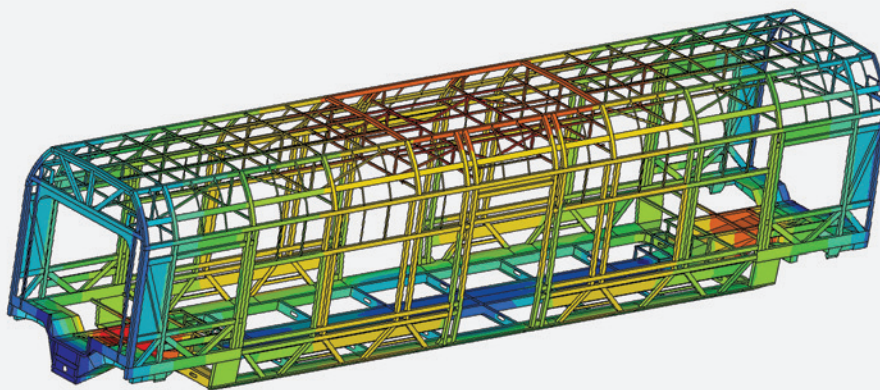
RAILWAY INDUSTRY



RAILWAY INDUSTRY

GES performs strength analyses for the broadly defined railway industry, in the design of both passenger and freight trains. We offer analyses of entire vehicles or selected assemblies, e.g. couplings, plough blades and equipment fasteners.

We offer HVAC analysis of carriage interiors for passenger comfort. Examples of these include galley air conditioning vent locations and minimizing peak temperatures within the passenger seating areas. Our CFD modeling capabilities ensure that sensitive equipment such as switch inverters under the carriage are properly ventilated and do not trip in adverse environments such as standing trains in tunnels or underground stations.



The railway wagon frame total displacement.

OUR RANGE OF STRENGTH ANALYSES INCLUDES:

- short-term strength analyses according to European Standards
- fatigue strength analyses
- fundamental vibration analyses
- buckling analysis
- optimization of structures in terms of stress reduction
- topological and topographical optimisation of structures

As part of our services for the railway industry, our personnel are able to make modifications to rail structures to improve short-term and fatigue strength levels.

The proposed modifications allow for designing structures for stationary strength tests, with the possibility to reduce the weight of the tested structure (while maintaining the required strength level) for reducing production costs.

SHIPBUILDING AND OFFSHORE INDUSTRIES

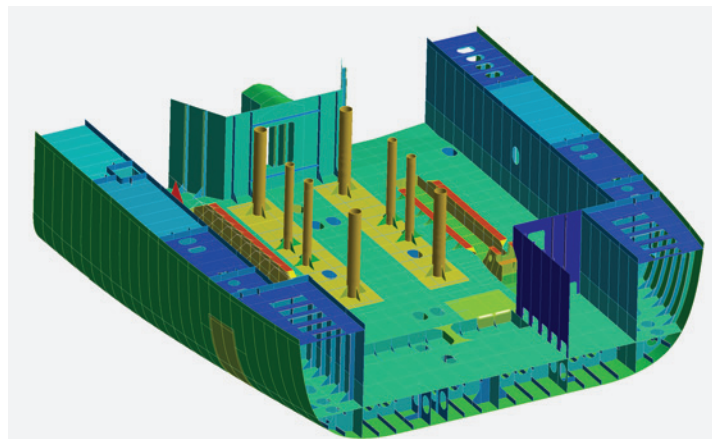


SHIPBUILDING AND OFFSHORE INDUSTRIES

We have considerable experience of performing analyses for the shipbuilding and offshore industries using the finite element method, in accordance with the requirements of classification associations.

We are prepared to perform comprehensive strength analyses for structures, including:

- ultimate strength analysis
- determination of environmental stresses for specified water reservoirs
- strength analysis for ship hulls
- strength analysis for offshore structures
- strength analysis for helipads
- acoustic analyses for hull areas
- analysis of crane supports and foundations
- hull docking analysis
- buckling analysis
- (low- and high-cycle) fatigue strength analyses
- fundamental and forced vibration analyses.

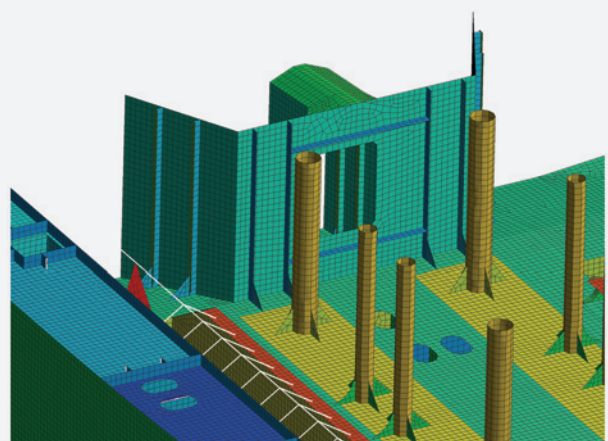


The ship geometry for a strength analysis.

By working with our Customers, we design new, modify existing and repair watercraft. In our solutions, we suggest design changes to improve strength levels and facilitate the process of obtaining approval of the watercraft documentation from the classification associations.

General Engineering Solutions perform strength analyses for different types of vessels:

motor yacht • car carrier • AHTS vessel • passenger vessel • Ro- Ro vessel • gas carrier • tanker • oil ocean barge • bulk carrier • jack UP • FPSO • multipurpose offshore vessel • container vessel • heavy lift vessel • motor yacht • oil ocean barge.



The final mesh for a structure strength assessment.

PARTNERS

It is our priority to build and maintain positive relations with our partners and the community. Our goal is to be fully trusted by our Customers and our Employees, who are the potential for the development of our company.



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GENERAL ENGINEERING SOLUTIONS

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