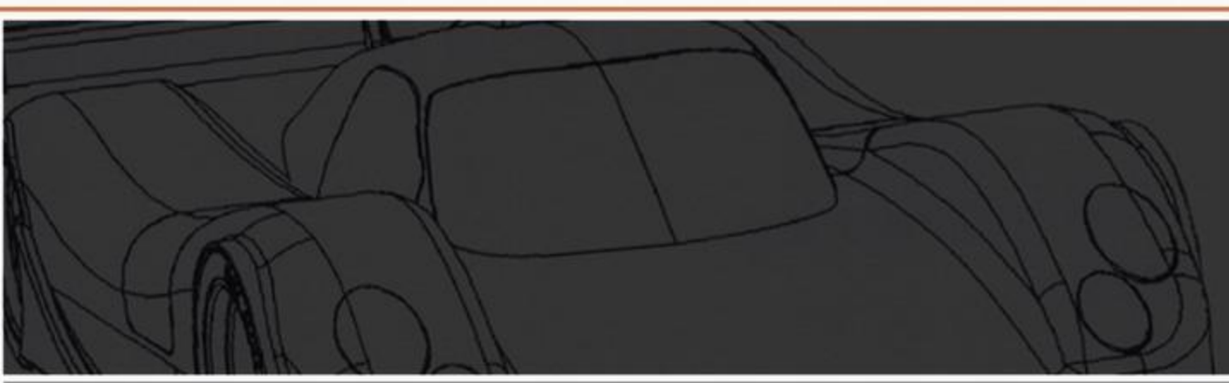
AUTOMOTIVE ENGINEERING DESIGN



aedesign.

INDUSTRIAL MACHINE DESIGN

Welcome to AEDesign, the premier engineering design and consultancy company in Pakistan. We specialise in the engineering and analytical related services for the automotive sectors and industrial machinery manufacturers. AEDesign provides its clients with professional, experienced design and engineering services while maintaining a focus on economical, on-time delivery.

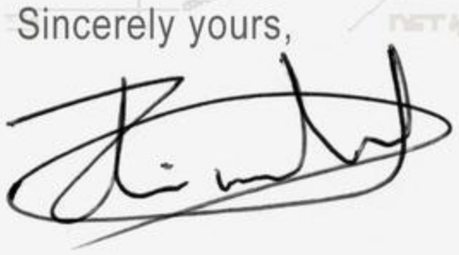
AEDesign assists our clients from concept through validation to finished prototypes and/or finished products if requested. Our professional in-house team brings your ideas to fruition, be it an integral part of a sub assembly or an entire system. Each of our engineers hold international degrees and bring a level of expertise adaptable to a changing manufacturing environment without compromising their professional integrity or the quality of their technical services.

I founded AEDesign in 2002 with a focus on providing engineering services to the automotive industry. Since these early days, we have expanded our horizons to include motor sports, recreational, aerospace and industrial machine design. Our clients are world-wide with most residing in Europe and the United States. My continuing dedication to excellence is carried forth throughout the team. We view engineering challenges with excitement, and produce with vigor.

So why choose AEDesign for your next project? Our level of expertise is unmatched. Our dedication to your project is unwavering. And our operational costs are low enabling extremely cost-efficient project management and execution especially when compared to in-house operations.

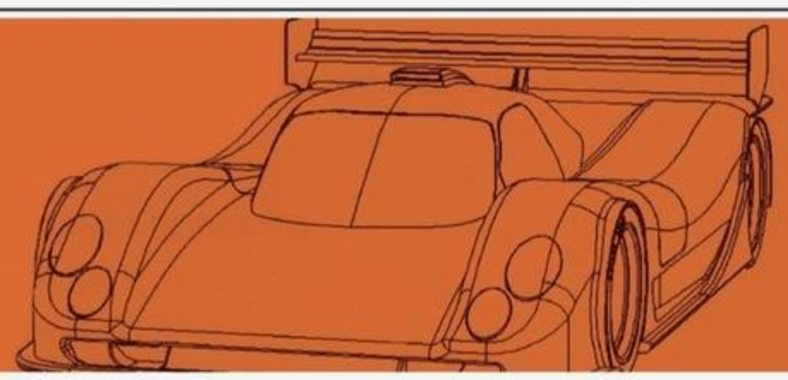
Allow us the opportunity to discuss your engineering challenges. I invite you to review the enclosed material covering our automotive and industrial machine design capabilities, and contact me to discuss your needs.

Sincerely yours,



Zaafir Waheed
CEO

AUTOMOTIVE DIVISION



At AEDesign, we specialise in creating cost effective engineering solutions for automotive industries located throughout the world. Since 2002, we have provided outsourced engineering solutions in the automotive and motor sports industry.

AEDesign's mission is to provide engineering solutions to satisfy the most discriminating client. Our internationally degreed engineers utilise modern, state-of-the-art hardware and engineering software to provide extraordinary results in all aspects of your project. In addition to the commercial engineering software packages we employ, we have found that it is sometimes necessary to create certain specialised programs custom tailored to the specific requirements of the project, and we have developed many proprietary tools to create solutions that meet and exceed the expectations of our automotive clients within their acceptable timeframes and budget.

Our client is based primarily in Europe, the United States and our home market.

We offer four basic levels of service:

- Conceptual Design
- Computer Aided Engineering services based on Finite Element Methods
- Structural and Component Design
- Standard Compliance and Validation

Our skilled and motivated team of engineers have special focus on the following areas:

- Race Car Design
- Speciality Vehicle Design
- FEA Analysis For:
  - *Linear Static & Dynamic Analysis*
  - *Non-Linear Static & Dynamic Analysis*
  - *Crash Safety*
  - *Durability Simulation*
  - *Meshing*
  - *Component Design and Analysis*
  - *Vehicle Dynamics*

We invite you to contact us to discuss your automotive engineering requirements, and discover how AEDesign can assist you by developing rewarding solutions for your automotive challenges.

Vehicle Development Projects

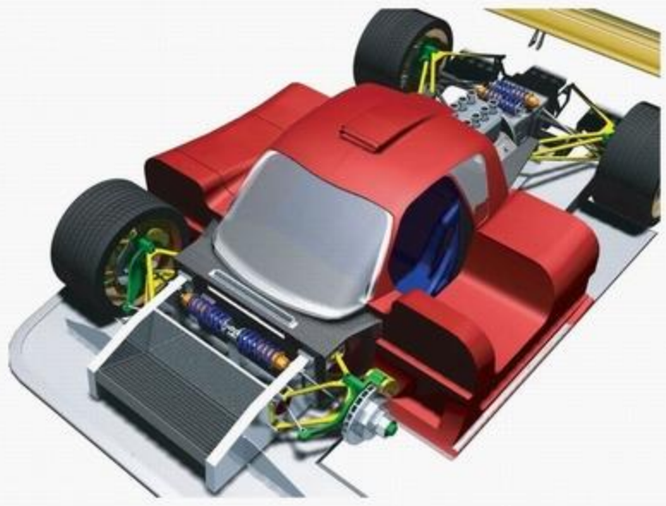
ZED 01 SPORTS RACER

The ZED 01 was designed as a concept car to showcase the automotive design skills and expertise of the company. The project involved applying all the skill sets of the company as well as those of our sister concerns. The basic design brief was to make a performance focused vehicle that could seat 2 people and was powered by an efficient high output 2.0 litre engine. The construction is a combination of tubular steel and composites, resulting in an extremely light and stiff structure. Many suspension parameters of the vehicle are adjustable allowing for the vehicle to setup to suit different driving styles and race circuits. From concept to first prototype, the project was completed within 10 months.

Finite Element Analysis methods were extensively used to optimise and verify the structural integrity and crash worthiness of the whole vehicle. Please see the section on CAE to learn more about this part of the project.

PROTOTYPE RACER CAR

This design project was commissioned by a client interested in developing a vehicle suitable for a single type race series. After successful launch of the race car, a modified road legal version is to be developed. The vehicle is fully FIA compliant and powered by a V12 engine with a displacement of 6.0 Litres. The structure is based around a carbon fibre tub with aluminium used for suspension components. Full analysis for the structural stiffness and strength along with crash safety has been carried out. CFD analysis was also performed to streamline the aerodynamic characteristics of the car.



ARMAMENTS LIFTER TRUCK

AEDesign was commissioned to design a speciality vehicle for use in arming jet aircraft with various types of payloads. The lifter picks up loads from a trolley or rack, and then places them to hard points or pylons on the aircraft. The vehicle had to comply with MILSPEC standards. All systems of the vehicle were designed and conceived by us.

COMPUTER AIDED ENGINEERING

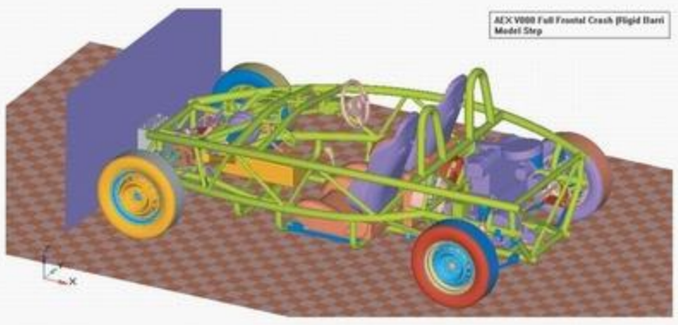
AEDesign specialises in providing the Automotive industry with a complete range of Finite Element based analysis and optimisation services. We have extensive experience of working with large reputable companies based in Europe as well as the United States. Our clients include OEMs as well as Tier 1 design companies and suppliers.

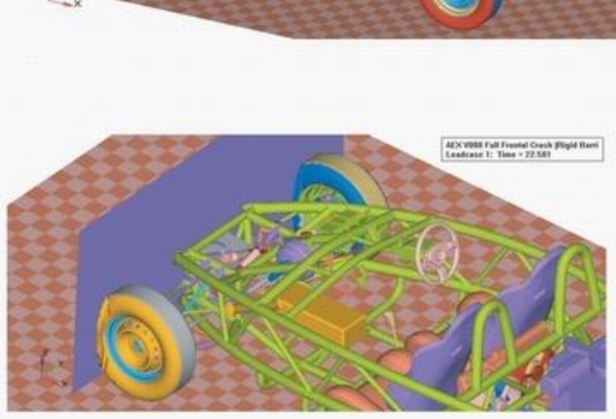
We are able to carry out the following types of Analysis and Calculations:

- Linear Static and Dynamic Stiffness
- Linear Vibration / Acoustic
- Linear Static Strength
- Durability Analysis (Fatigue Calculations)
- Non-Linear Failure Calculations
- Non-Linear Crashworthiness Analysis
- Stamping Simulations

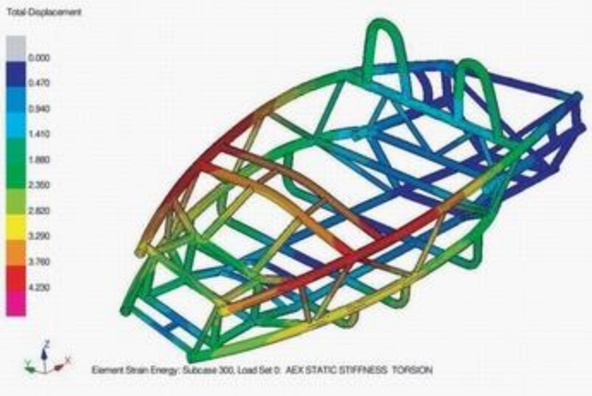
ZED 01

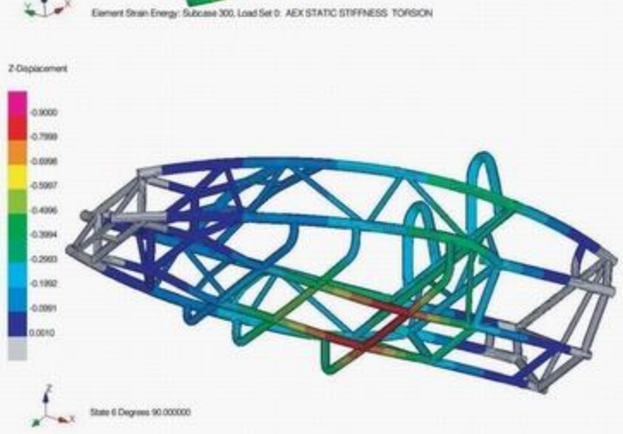
The ZED 01 development project called for comprehensive simulations to be carried out. These included stiffness, strength, front and side crash and durability. The simulation process validated our automotive design knowledge and also allowed us to show case the complete range of our abilities.



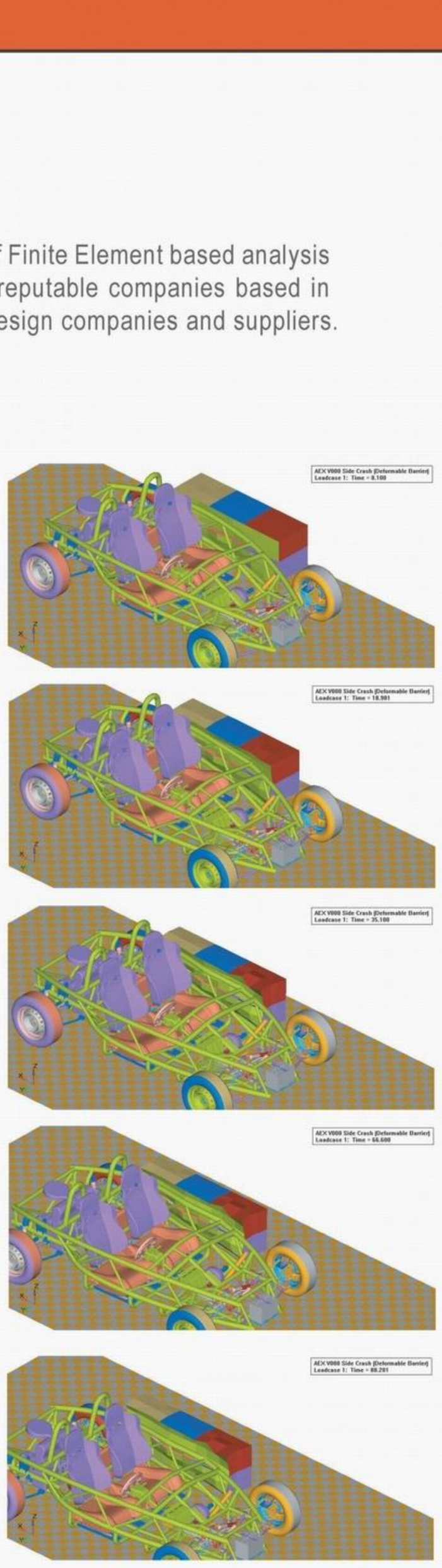


Full frontal crash with rigid barrier





Torsion and bending



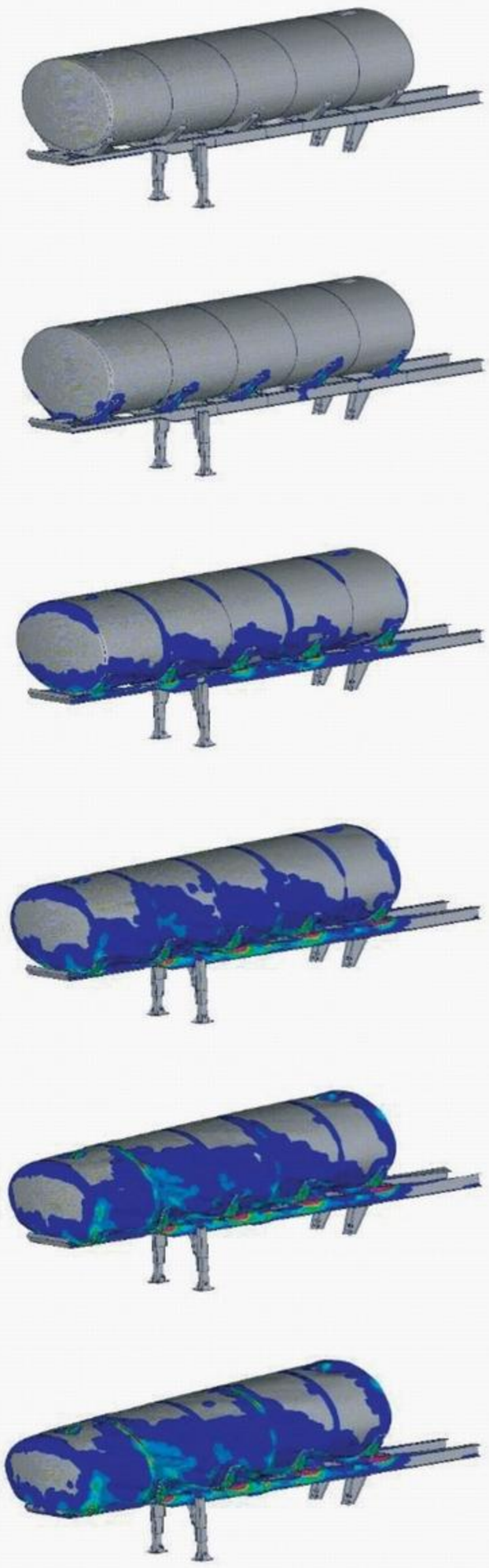
Side crash, deformable barrier

RE-FUELLING TANKER

The manufacturer of the fuel tanker tasked us to define load cases and perform crash testing for a newly designed trailer type fuel tanker. A full set of varying load cases was defined covering the various types of anticipated loads during service as well as during emergency situations.

Simulations were carried out and design weaknesses were identified for the client. Subsequent design modifications and re-enforcements were made resulting in the design passing the crash testing. The results were verified by the relevant authorities and production go-ahead given for the tanker.

The series of images shows the different stages of the crash simulation prior to design modifications. It is clearly visible that the mounting lugs failed under heavy deceleration causing the rest of the structure to deform as a result.



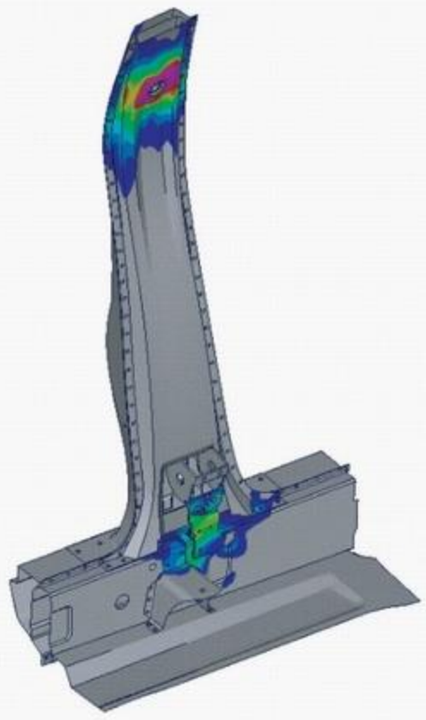
Emergency braking simulation

C-CLASS PASSENGER CAR

AEDesign was involved in the analysis and optimisation of a c-class vehicle. This vehicle is currently being manufactured and sold in Pakistan.

We were primarily given the responsibility to carry out Linear and Non-Linear Static testing for this vehicle. Several modifications and improvements were carried out on the model to improve the stiffness of the chassis. Some examples from this project are illustrated below.

Torsional stiffness simulation (Linear)



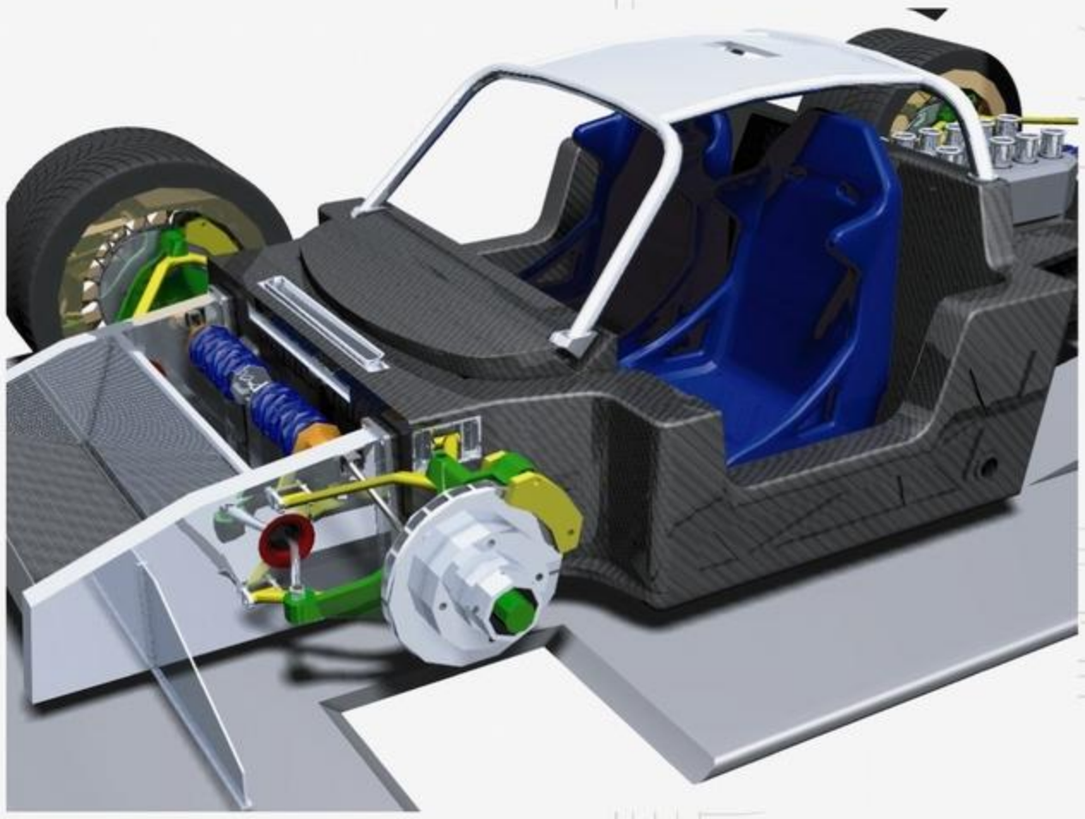
Seat belt anchorage simulation (Non-Linear)

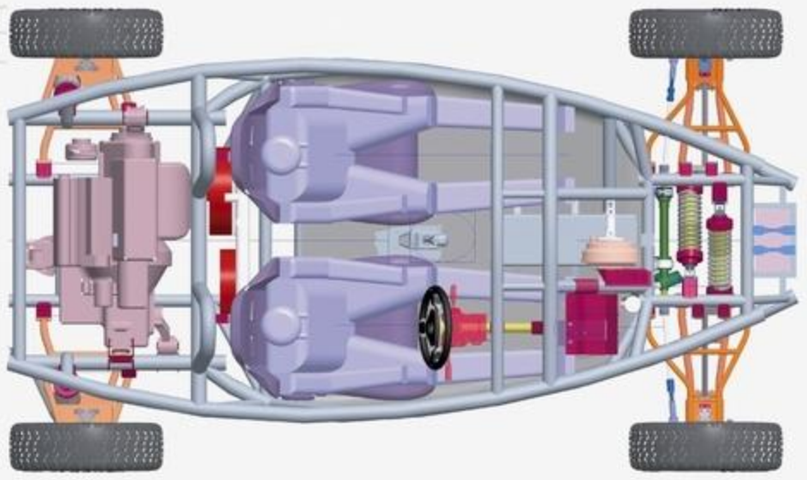
CAD MODELLING

3D CAD programs have revolutionised the way work is carried out for engineering projects. The possibility to virtually view the finished part or assembly and to check its functionality can save valuable time in the development process. AEDesign is able to work with most popular CAD packages currently available. Our highly skilled and dedicated team is able to provide a range of CAD design services to cater for the needs of different engineering sectors.

Not only are we able to create new designs in CAD, we are also able to carry out detail design work as well as the generation of engineering drawings which can directly be passed on for manufacturing. It is also possible to convert legacy 2D CAD and paper drawings into 3D CAD format.

AEDesign is able to bring great value to our clients through the execution of such projects. Not only are we able to provide a cost effective high quality solution, but also have the ability to turn projects around in a short time period. With the outsourcing of work to us, the client's in-house engineering resources are freed up for other work.





INDUSTRIAL DESIGN DIVISION

At AEDesign we specialise in creating cost effective engineering solutions for Industrial and Machine manufacturing sectors. We provide our customers a range of design and analysis services to cater for all their needs. Clients can also benefit from having access to additional engineering resources without having to increase their own strength on a more permanent basis. The existing engineering resources can also be deployed more efficiently through such outsourcing activity.

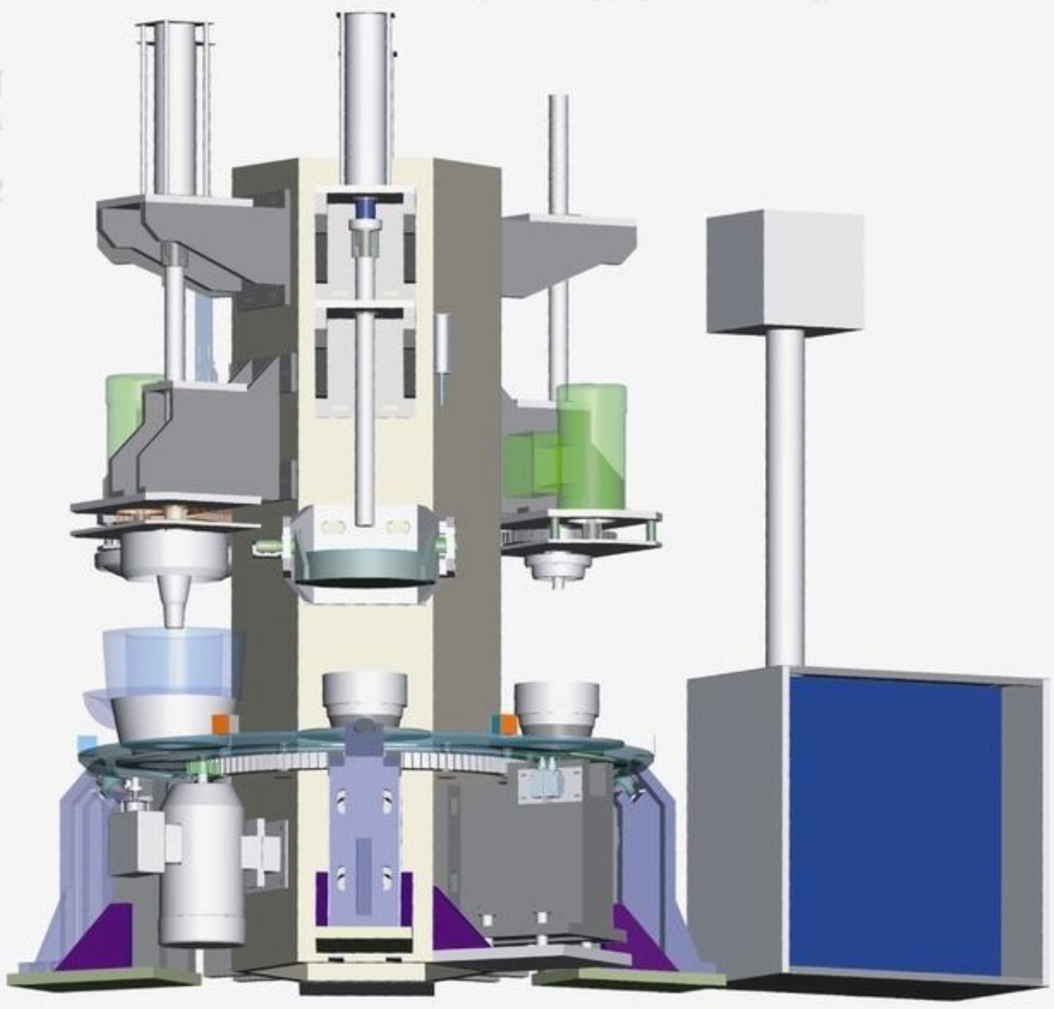
Our design services include;

Conceptual Design

We are able to create our own concepts or work with our clients to develop designs which are able to fulfil their requirements. From the concept stage we usually proceed to the detail design work and then completion of a comprehensive engineering package which is production ready.

Detail Design

In several cases the client already has the conceptual design ready. In this case we work closely with our clients to understand their design and requirements. Once we fully understand their needs we then proceed to do the detail design work necessary to make the concept into a fully functional complete design. This is usually followed by creation of engineering drawings and a complete engineering package that can be passed on for manufacturing. This provides clients with a cost effective solution and also frees up in-house engineering resources to be used in more productive ways.



2D to 3D CAD Conversion

In certain cases our clients have CAD data that is in a 2D legacy CAD format. Any work to update the designs or change them can be uneconomical if the data is not in 3D format and compatible with current CAD programs. In this case AEDesign is able to provide assistance by upgrading the design from 2D CAD into most popular 3D CAD formats.

Generation of Engineering Drawings

It is usually very economic and competitive to outsource the task of making engineering drawings. AEDesign is able to produce these very effectively and efficiently for clients. In addition, it also frees up the client's engineering resources to be deployed in a more productive exercise.

Our client base in industrial machine design is primarily based in Europe, with particular focus on the Netherlands and Germany.

We invite you to contact us to discuss your manufacturing engineering requirements, and discover how AEDesign can assist you by developing rewarding solutions for your industrial manufacturing challenges.

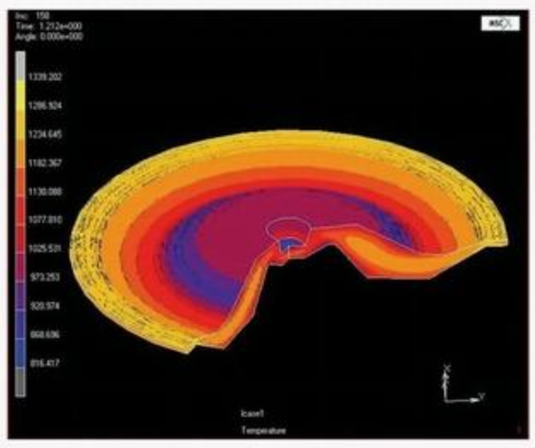
PRODUCTION SIMULATION

FORGING

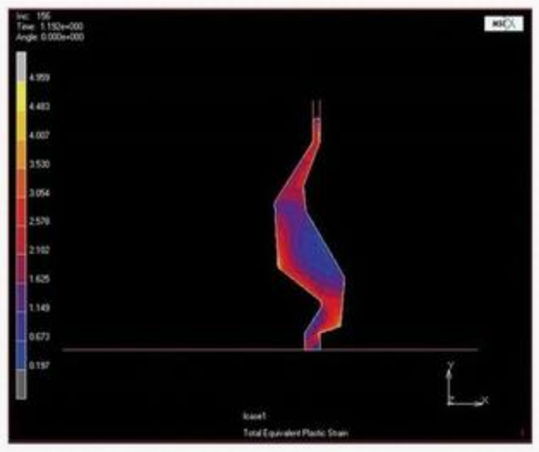
Using advanced FEA based simulation technologies it is possible to predict and optimise the complete forging cycle. The benefits of simulation start from reduced lead times and go all the way to improved acceptance rates for mass production. Using virtual development, the number of prototypes required are greatly reduced resulting in reduced time and cost. Tool and die life can be greatly enhanced by optimal design.

Some of the benefits include:

- Reduced lead times & prototyping cost
- Increase in die life cycle
- Proper material flow ,temperature control and reduction in waste material
- Optimal use of available presses by controlling the required force



FORGING TEMPERATURE DISTRIBUTION



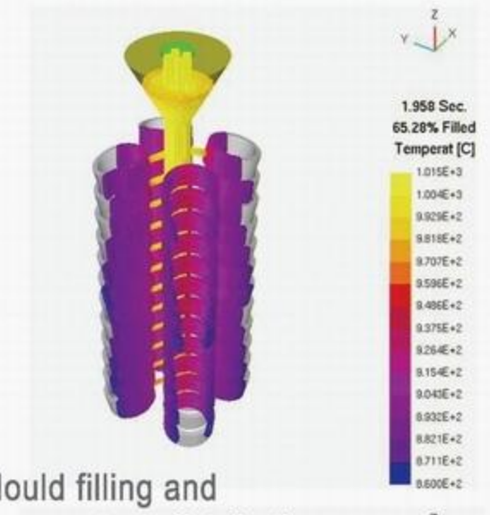
MATERIAL FLOW SIMULATION

CASTING

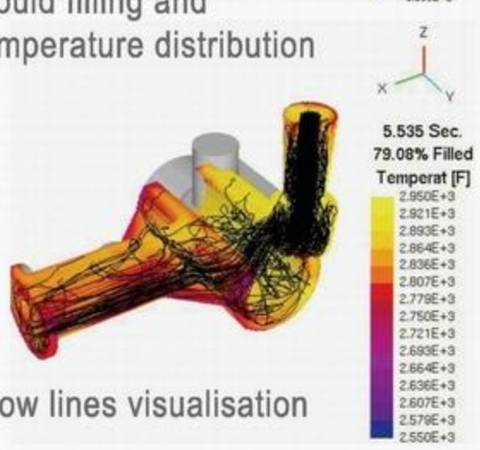
Modern FEA simulation techniques are able to offer many advantages in creating greater efficiencies in casting processes. Some of the areas where simulations can be helpful are mould design, thermal, flow and stress analyses. Metallurgy of the finished product can be controlled as well as the quality level of the finished part.

Simulations Benefits include:

- High and low pressure, sand casting and investment casting can all be simulated
- Thermal and flow optimisation
- Improvement of piston speeds, gating design and overflow positioning.
- Reduced material wastage



Mould filling and temperature distribution



Flow lines visualisation

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