European success stories with Industry

AMIES | Agence pour les mathématiques en interaction avec l'entreprise et la société

EU-MATHS-IN.se | Swedish Network for Mathematics in Industry

HU-MATHS-IN | Hungarian Service Network for Mathematics in Industry and Innovations

IMNA | Industrial Mathematics Network for Austria

KoMSO | Komitee für mathematische Modellierung, Simulation und Optimierung

MATH-IN | Red Española Matemática – Industria

PL-MATHS-IN | Polish Service Network for mathematics in Industry and Innovations

PWN | Platform Wiskunde Nederland

Smith Institute | Smith Institute for industrial mathematics and systems engineering

SM[i]^2 | Sportello Matematico per l'Industria Italiana

Small presentation

1 slide

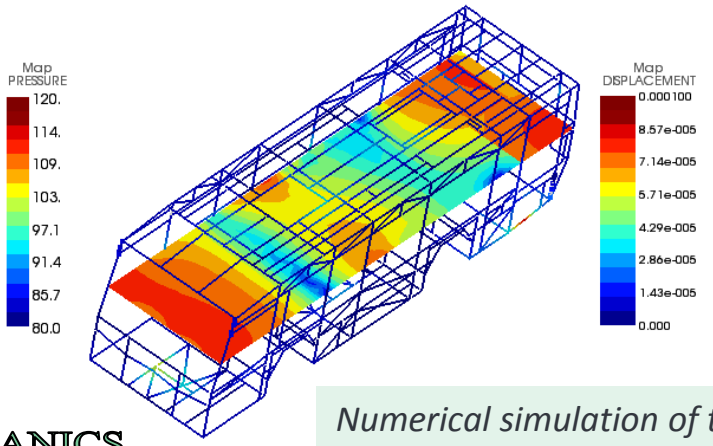
REDUCTION of NOISE and VIBRATIONS in BUSES

Challenge

To guarantee the passenger comfort and the structural reliability of the vehicle.

Goals

- To reduce cost and time of vehicle design cycles.
- To evaluate vibro-acoustic properties in new vehicles.
- To reduce noise inside the passengers' cabin.
- To minimize the vibrations acting on the vehicle structure.



Numerical simulation of the acoustic-structural model

MECHANICS AND MECHATRONICS

Benefits

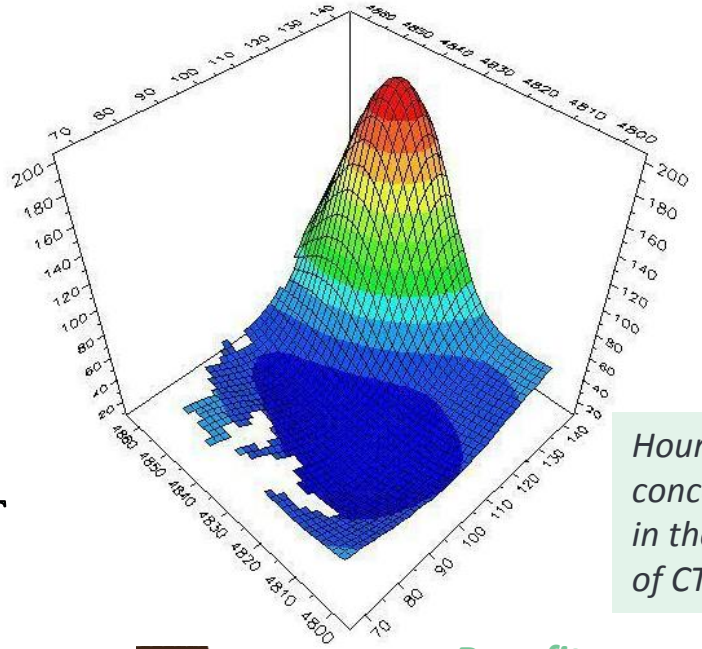
The company has a computational methodology to predict, design and optimize the acoustic behavior of their vehicles

PREDICTION of POLLUTION EPISODES at a POWER PLANT

Challenge

To predict a contamination event around the power plant.

ENERGY AND ENVIRONMENT



Hourly average SO_2 concentration map in the surroundings of CT As Pontes

Goals

- To reduce the emission of gases to the atmosphere.
- To control the immission or deposition at ground level of the chemical compounds.

Benefits

The company has a computer program to predict gases levels half an hour before they are thrown to the environment.

H2020 **SOCIETAL CHALLENGES**

Climate action, environment, resource efficiency and raw materials

OPTIMIZATION of STEEL FORGING

Challenge

Optimization of steel forging manufacturing.

Final product of the forging process

MECHANICS AND MECHATRONICS

Goals

- To reduce waste matter.
- To reduce press load to avoid mold breakage.

Benefits

Reduction of waste up to 49%, reduction of press load up to 31.4%.

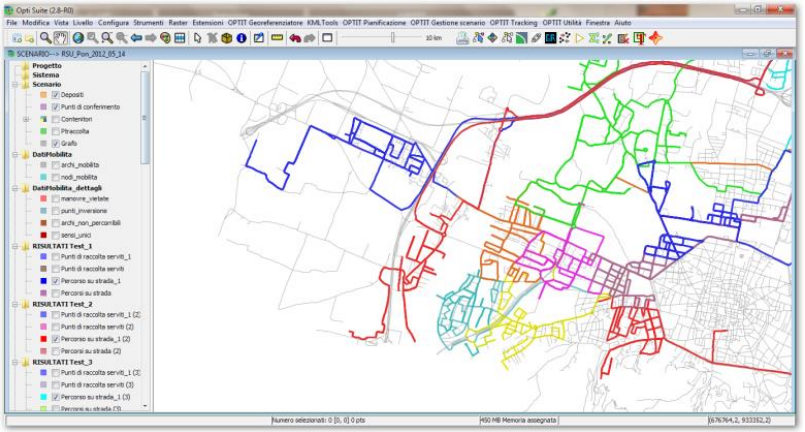
H2020 **SOCIETAL CHALLENGES**

Climate action, environment, resource efficiency and raw materials

GARBAGE COLLECTION OPTIMIZATION

Challenge

Optimization of garbage collection services over a large territory.



Snapshot showing the optimization path

ENERGY AND ENVIRONMENT

Goals

- Resize the service.
- Planning support over different areas.
- Quick update system.

Benefits

A decision support system that allowed cost reduction up to 20%.

Medium presentation

4 slides

REDUCTION of NOISE and VIBRATIONS in BUSES

H2020 **SOCIETAL CHALLENGES**

Smart, green and integrated transport

The Industrial Problem

Bus manufacturer Castrosua was interested in reducing noise inside the passengers' cabin, and minimizing the vibrations acting on the vehicle structure.

MECHANICS AND MECHATRONICS

Research group

Mathematical Engineering

mat+i Grupo de Investigación en Ingeniería Matemática

USC Universidade de Santiago de Compostela

To tackle problems relating to the simulation of devices and industrial processes, from mathematical modeling to the development of software packages.

Company

Carrocera Castrosua

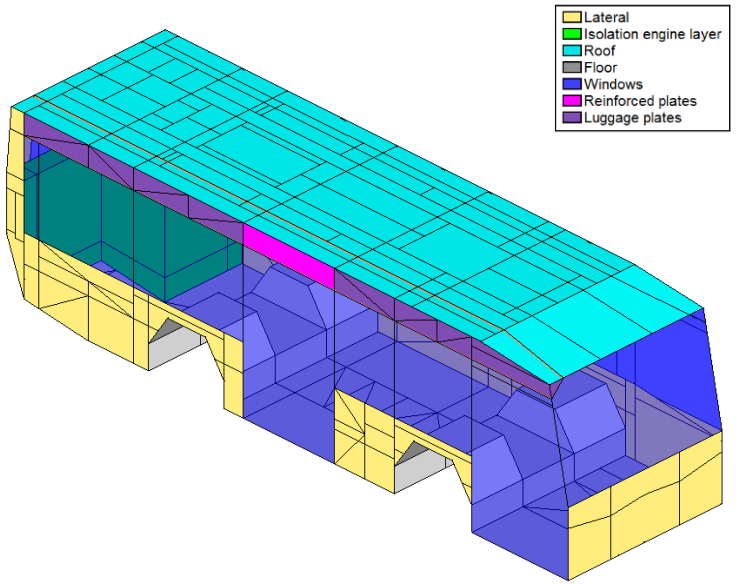
Castrosua

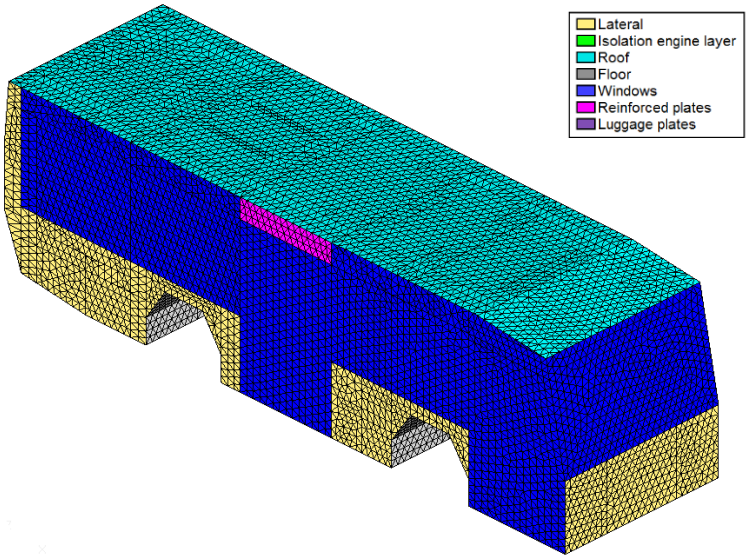
Bus manufacturer focused on the improvement of passenger comfort and vehicle reliability

REDUCTION of NOISE and VIBRATIONS in BUSES

Challenges & Goals

- To guarantee the passenger comfort and the structural reliability of the vehicle.
- To evaluate vibro-acoustic properties in new vehicles.
- To reduce noise inside the passengers' cabin.
- To minimize the vibrations acting on the vehicle structure.
- To reduce cost and time of vehicle design cycles.



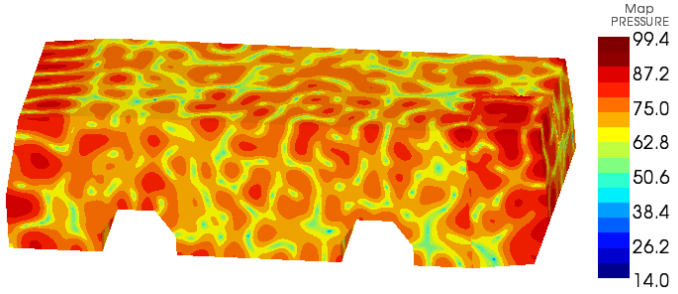


Geometry (left) and finite element mesh (above) of the bus structure

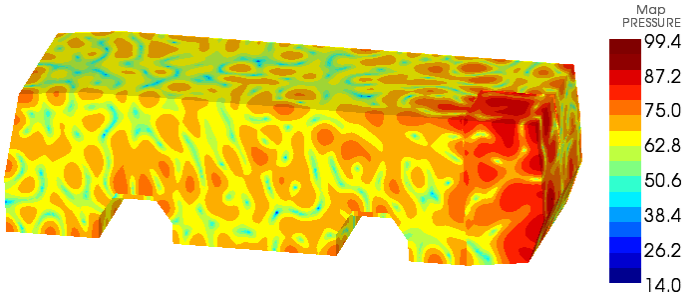
REDUCTION of NOISE and VIBRATIONS in BUSES

Mathematical and computational methods and techniques applied

- Mathematical modelling of the vehicle, both passenger cabin, and beams and plates of the vehicle structure.
- Finite element methods to obtain an approximate solution of both the sound pressure in the passenger cabin and the displacements in the structure.
- Numerical simulations aimed to assess the effectiveness of a variety of geometric configurations, different materials, etc.



Numerical simulation of the sound pressure at a frequency of 500 Hz

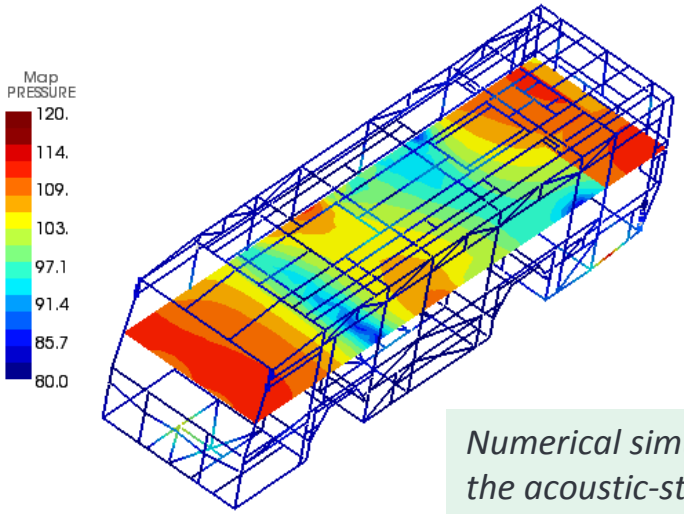


Numerical simulation of the sound pressure at a frequency of 500 Hz after applying passive coatings

REDUCTION of NOISE and VIBRATIONS in BUSES

Results & Benefits to the company

- Different acoustic solutions based on passive coatings of absorbent materials.
- Variety of geometric configurations.
- A new vehicle configuration with new materials and a distribution of patches of absorbent multilayer materials.



Numerical simulation of the acoustic-structural model

The company has a computational methodology to predict, design and optimize the acoustic behavior of their vehicles

PREDICTION of POLLUTION EPISODES at a POWER PLANT

H2020 SOCIETAL CHALLENGES

Climate action, environment, resource efficiency and raw materials

The Industrial Problem

As Pontes power plant was interested in controlling the environmental consequences of their power plant by predicting a contamination event around the power plant.

ENERGY AND ENVIRONMENT

Research group

Optimization Modelling, Decision, Statistics and Applications

Modelos de Optimización, Decisión, Estadística y Aplicaciones

Statistical modelling, data analysis and optimization with software development for industrial applications and efficient resource management.

Company

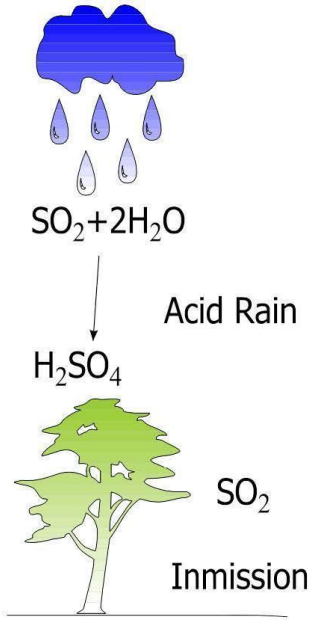
Endesa Generación

Endesa is an energy sector operator and provider of associated services, focused on electricity.

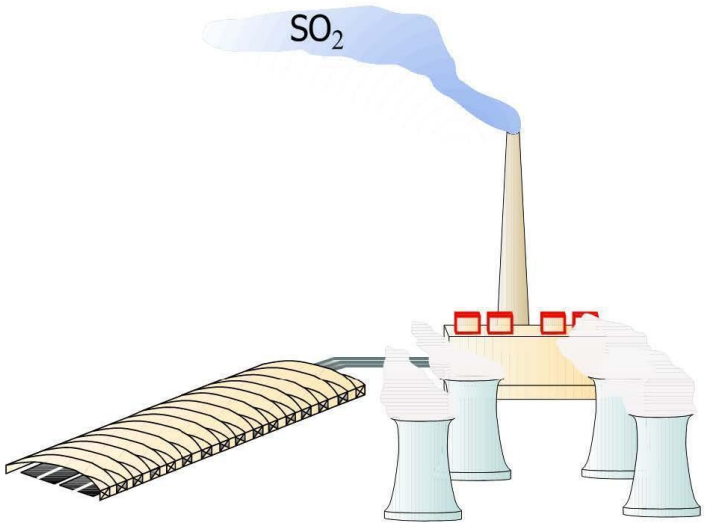
PREDICTION of POLLUTION EPISODES at a POWER PLANT

Challenges & Goals

- To prevent pollution episodes and subsequent ecological fines.
- To reduce the emission of gases to the atmosphere.
- To control the inmission or deposition at ground level of the chemical compounds.
- To generate automatic predictions in short periods of time.
- To design predictors for continuous, binary and space-like response.



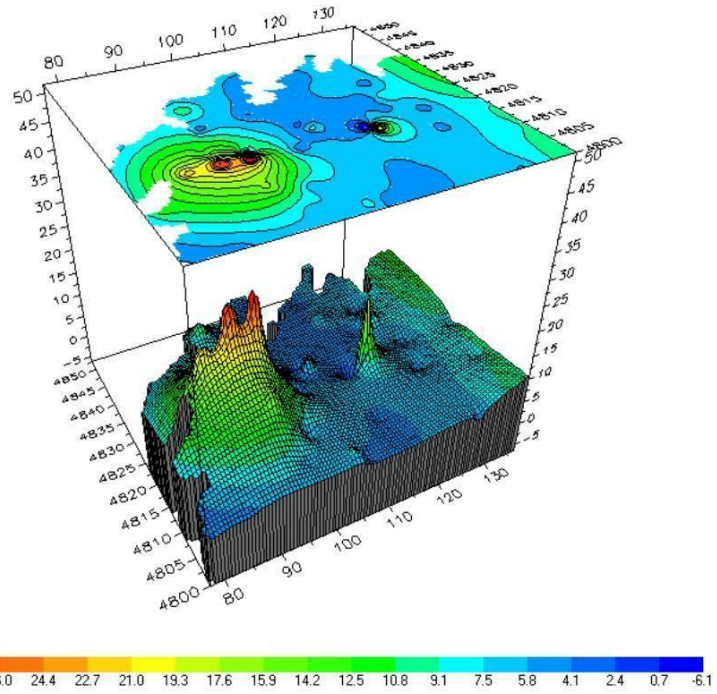
Outline of the SO_2 contamination process



PREDICTION of POLLUTION EPISODES at a POWER PLANT

Mathematical and computational methods and techniques applied

- Methods for predicting using semiparametric time series.
- Prediction methods with binary response based on generalized linear models (GLM).
- Prediction methods with multidimensional response and cointegration.
- Methods for predicting using spatial techniques.
- Prediction methods based on neural networks.
- Prediction methods with functional data (FDA).

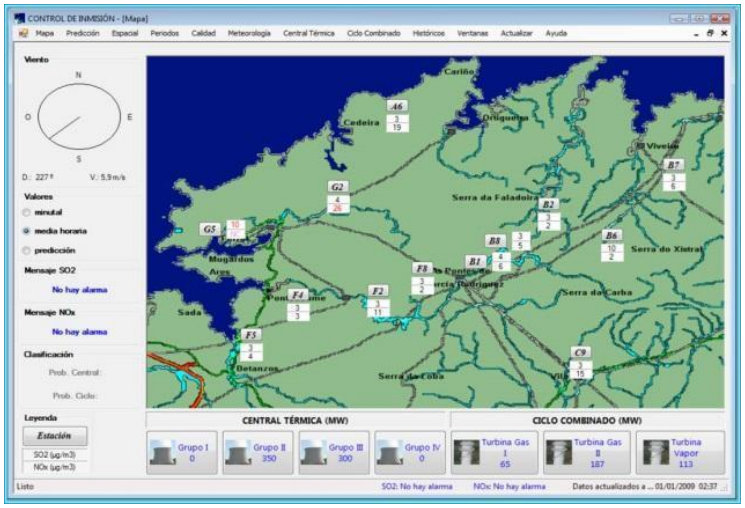


Spatial prediction of SO_2 concentration levels in thermal power stations

PREDICTION of POLLUTION EPISODES at a POWER PLANT

Results & Benefits to the company

- SIPEI, a developed computer program, produces predictions of gases levels half an hour before they are thrown to the environment.
- 25 years of a successful collaboration between the Department of Statistics and Operations Research of the University of Santiago de Compostela and As Pontes power plant on environmental modeling and control.
- Staff and researchers formation: 6 thesis, more than 20 publications in high impact journals.



SIPEI, main window

The company has a computer program to predict a contamination event adapted to current legislation

OPTIMIZATION of STEEL FORGING

H2020 **SOCIETAL CHALLENGES**

Climate action, environment, resource efficiency and raw materials

The Industrial Problem

Optimize the forging process in economical and energetical terms to obtain a final product without defects and improve the stress behaviour of the mold.

MECHANICS AND MECHATRONICS

Research group

Enginsoft

International corporation of consultancy in the field of Simulation Based Engineering Science.

Company

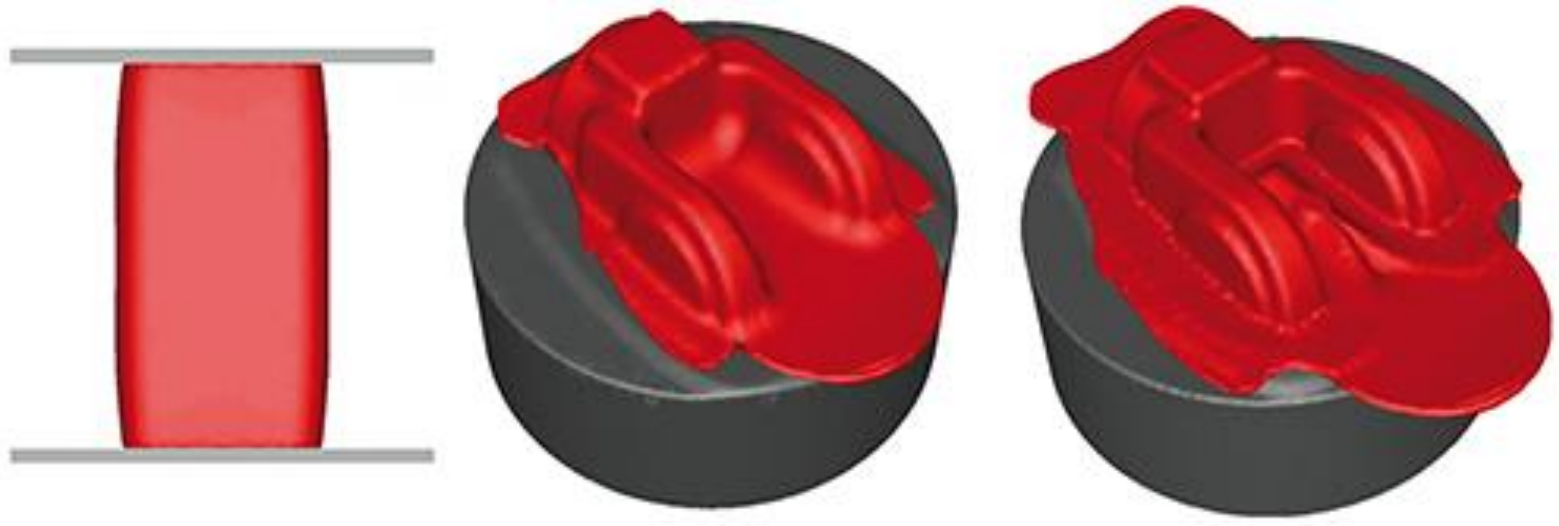
Feat Group

Steel forging, forging processes of mechanical and engineering components.

OPTIMIZATION of STEEL FORGING

Goals

- minimize material waste ensuring the accurate replenishment of the mold;
- guarantee the uniformity of metal fibers that influences physical properties of the final product;
- reduce the occurrence of mold breaking during the deformation stage through the action of a press.

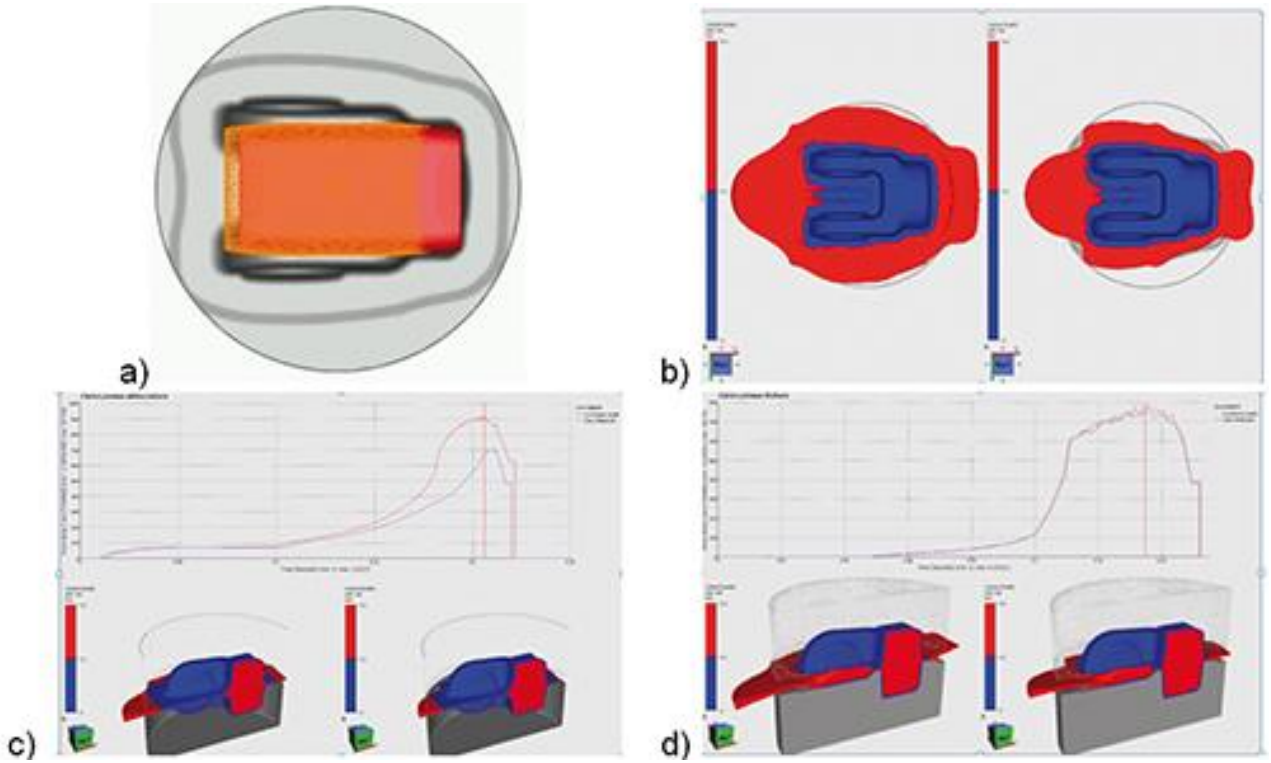


Numerical simulation of the forging process

OPTIMIZATION of STEEL FORGING

Mathematical and computational methods and techniques applied

- Finite Element Analysis of the entire production process to describe in detail all the stresses and determine the causes of final product defects;
- an optimization procedure to minimize material waste and deformation press strain.

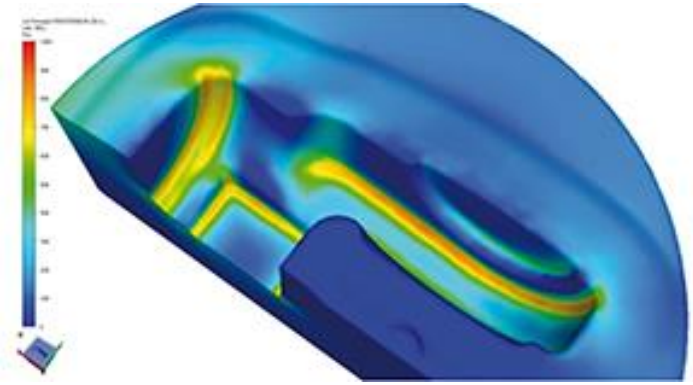


Different stages of the Optimization procedure

OPTIMIZATION of STEEL FORGING

Results & Benefits to the company

- 27% to 49% of waste reduction;
- 31.4% of press load reduction.



Simulation of the stresses on the mold

The numerical modelling also suggested additional optimization factors to improve several production cycles and to design new products and production processes

GARBAGE COLLECTION OPTIMIZATION

H2020 **SOCIETAL CHALLENGES**

Climate action, environment, resource efficiency and raw materials

The Industrial Problem

Gruppo Hera needed an optimized system to manage the operations of garbage collection over different areas.

ENERGY AND ENVIRONMENT

Research group

Optit

OPTiT optimal solutions

University of Bologna Spin Off, that develops forecasting and optimization solutions based on the state of the art Operations Research.

Company

Gruppo Hera

GRUPPO HERA

Leader in the management of services related to environment and energy.

GARBAGE COLLECTION OPTIMIZATION

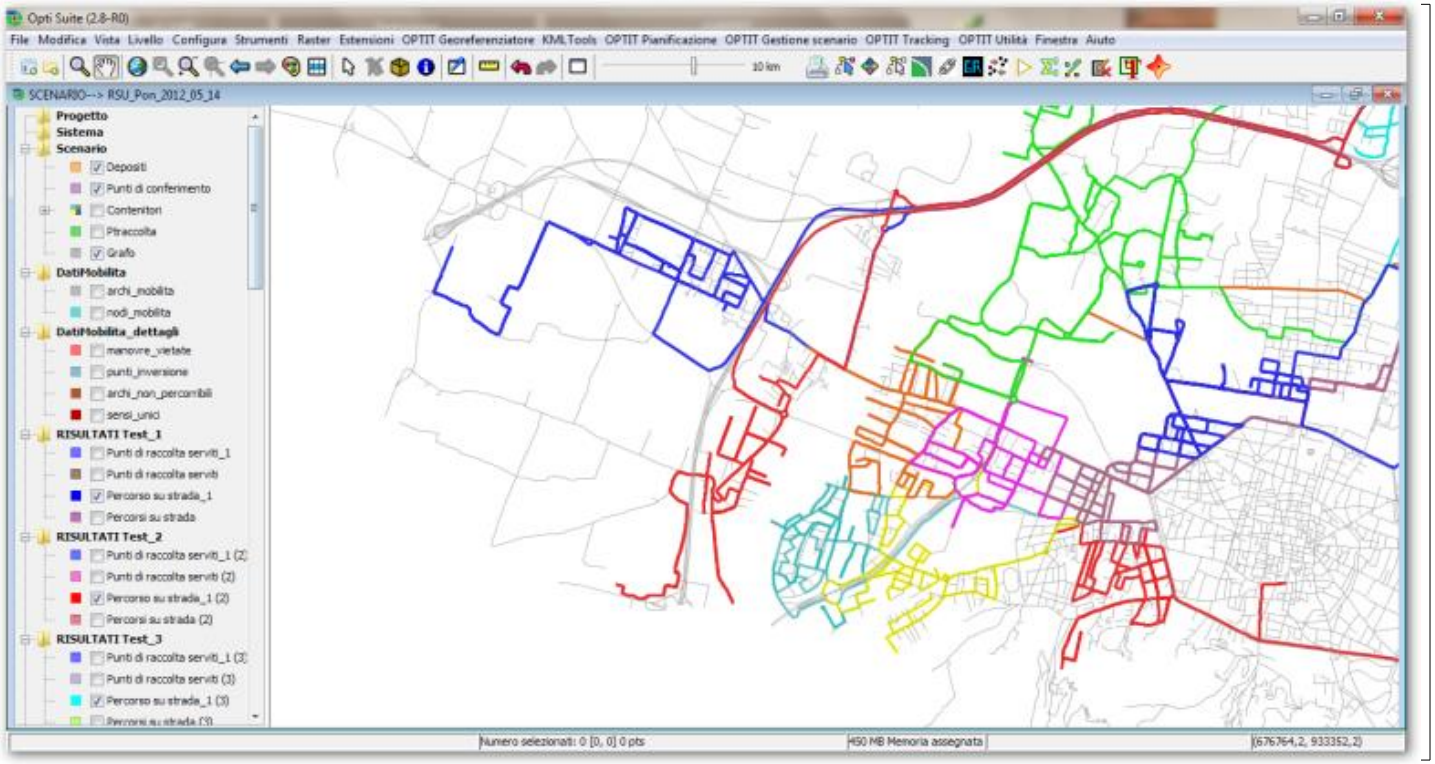
Goals

- Decision Support system to plan all the garbage collection activities.
- Reorganization of the services.
- Planning update systems to take into account uncertainties such as variation of mobility.

GARBAGE COLLECTION OPTIMIZATION

Mathematical and computational methods and techniques applied

- A conceptual Framework for decision support.
- An optimized routing tool to plan the operations in full detail
- Implementation of GPS Data into the framework



Snapshot showing the optimization path

GARBAGE COLLECTION OPTIMIZATION

Results & Benefits to the company

- Time reduction for solution generation: from weeks in case of manual planning of a single scenario to few days to generate two to three alternative solution scenarios .
- Reduction of operational costs (number of shifts, number of km) in the range 3% - 20%.

The company has a decision support system to help planning the service in full detail