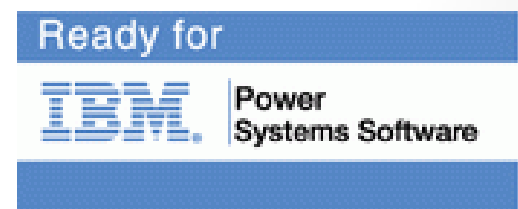


FIDESYS

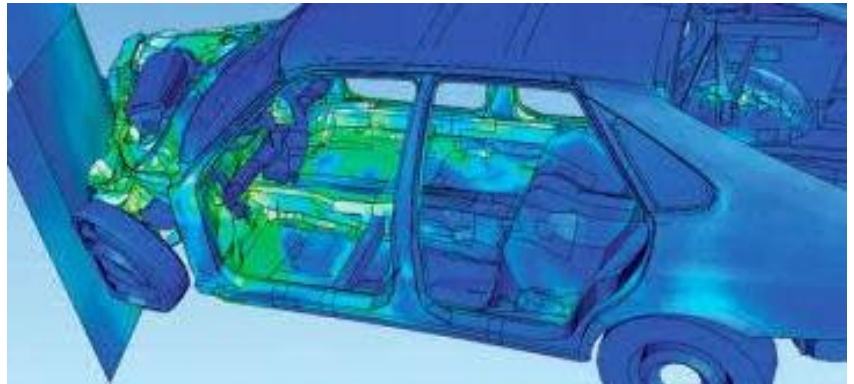
**The first Russian-developed next-generation
software suite for structural analysis**

Sk
Skolkovo



SOLUTION

You can do it either
by **creating a prototype** or by making a computer simulation,
which is cheaper.



FIDESYS

is a next-gen
computerized solution.

Our solution - Next Generation Software:

- Increased accuracy of simulations
- Dramatically increased speed of simulations

Supercomputer speed
of simulation



Achieved on a simple
laptop

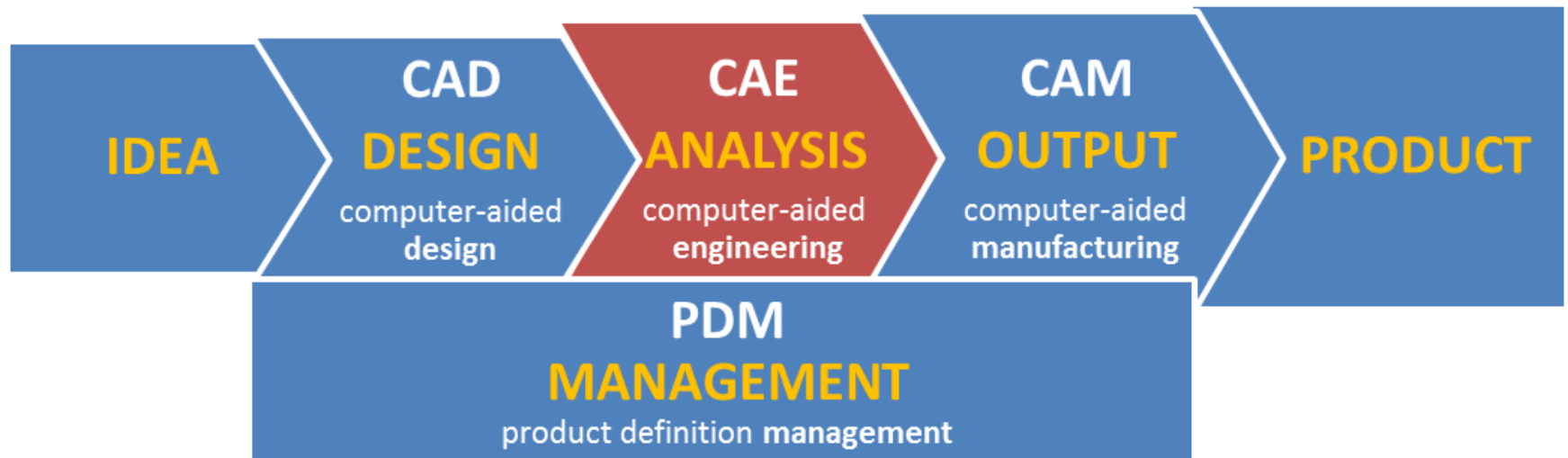


WHAT IS OUR PROJECT ABOUT?

FIDESYS is an engineering company that specializes in providing engineering simulation software solutions and consulting services.

Currently FIDESYS has concentrated on creating its own CAE software package.

Computer-aided engineering systems (CAE) are the computer-based tools to assist simulation, validation, and optimization of products and manufacturing tools. CAE is the central part of *product lifecycle management* product line:



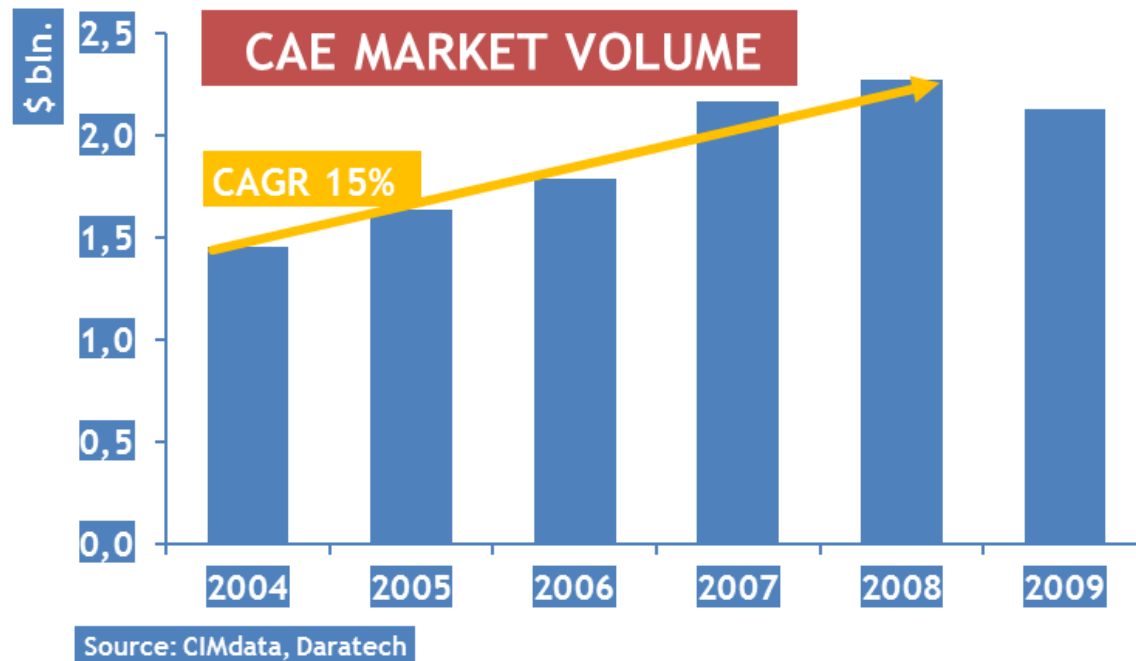
FIDESYS

HOW LARGE IS THE TARGET MARKET?

Total volume of world CAE market in Y2010 exceeded \$2 bln.

Market saturation is believed to be at 20%.*

Despite the fact that difficult macroeconomic environment negatively affects many industries that utilize CAE products, an ensuing focus on cost saving will stimulate more active usage of CAE systems as a way of decreasing costs for developing new products.

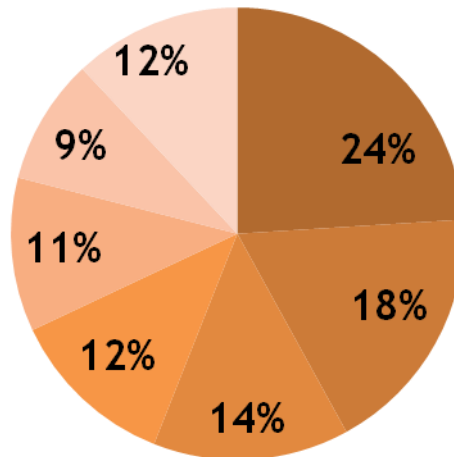
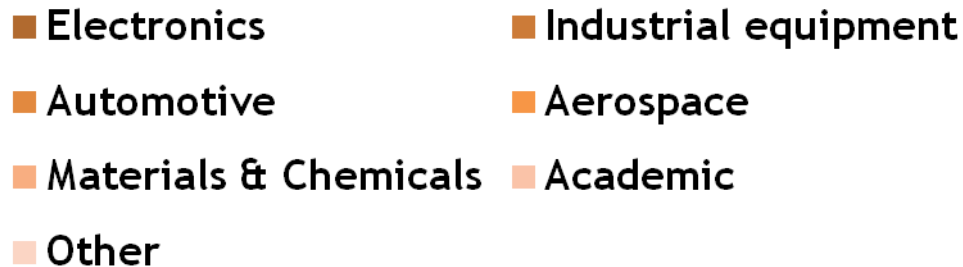


* According to JP Morgan report.

FIDESYS

WHO ARE THE CUSTOMERS?

Automotive, aerospace and industrial equipment industry are traditional users of CAE systems. Nevertheless, in recent years “newer sectors” like hi-tech, consumer goods and energy has shown faster growth in CAE adoption.



FIDESYS

WHO ARE THE RIVALS?

CAE market is divided between US and EU players.

There is no Russian players, which makes FIDESYS the first.



FIDESYS

WHY ARE WE BETTER?

- *We use a technology that is more accurate and less hardware demanding*

For existing rivals the use of that technology is nearly impossible, as it will require the full reconstruction of their systems.

- *We are the first Russian player on CAE market*

Being Russian on CAE market will allow to build special relationships with CIS customers and use government support.

- *We have lower costs*

As a company based in Russia FIDESYS can enjoy more favorable pricing for highly educated engineering personnel.

- *We have a lower price*

With customers finding themselves on tighter budgets for R&D, the influence of pricing of CAE software licenses increases considerably.

FIDESYS

COMPETITIVE ADVANTAGES

Features	FIDESYS	ANSYS
Models&Methods	Superposition of strains, general case Superior math methods: SEM / DG / DG-SEM / MD Adaptive automatic mesh generation	Small/finite strains FEM only Manual mesh regeneration
Hardware requirements	Full CUDA/OpenMP/MPI support	High –RAM + CPU/hours
Cloud computing + Saas	Web-client: Fidesys online	Not supported
Price	\$ 2 700 – \$ 20 000	Up to \$ 100 000

The Team

- **CEO of the Project**

Vladimir A. Levin, Doctor of physical and mathematical sciences, Professor of Moscow State University, Department of Mechanics and Mathematics, Computational Mechanics.

- **Board member**

Arseny A. Tarasov, World-class expert in the field of corporate sales of complex software; ex-VP of Parametric Technology Corp, Worldwide Regional Director of the Year 2008; ex-Managing Director of Siemens Enterprise Communications Russia & CIS

- **CTO of the Project**

Anatoly V. Vershinin, Candidate of physical and mathematical sciences, Associate professor of Moscow State University, Department of Mechanics and Mathematics, Computational Mechanics.

- **Head of R&D**

Valery I. Levitas, Doctor of physical and mathematical sciences, Doctor-Engineer habil. in Continuum Mechanics Schaefer 2050 Challenge Professor, Department of Mechanical Engineering and Department of Aerospace Engineering, Department of Material Science and Engineering (courtesy appointment), Iowa State University

- **Technology development team**

Group of graduates (3 PhDs under 28), PhD and masters students of Department of Mechanics and Mathematics of Moscow State University.

Currently, the team is geographically located in the Science Park of Moscow State University.

- **Consulting professors**

9 professors (incl. 2 RAS corresponding members, full professor of the University of New Hampshire), 2 of them with full-time engagement.



Our services

- **Sales of software suite and support services**

Three types of licensing: Corporate, University and Research. Service support will vary from 10% to 20% of the annual license costs, that does not exceed the fraction of the cost of service support of the main competitors (Ansys, SolidWorks, Nastran) (in %% of the cost of the license).

- **Pay-as-you-go access to Web-based Cloud-computing SaaS version of the product**

At the current (starting) stage of the Project we are going to make a limited version of the software available via a SaaS framework for free in order to promote the company as well as receive early feedback from our customers. As the development progresses, we will make available a version with significantly more features for use via a paid subscription. On June 29, 2011 we launched a basic (stripped-down) version of the Fidesys Online, including only one processing core (Finite element method) and limited functionality.

- **Specialized custom industry-specific products for large corporations**

Companies operating in highly specialized industries (e.g. industrial equipment production) often require a customized approach to engineering simulation and thus require CAE software that will take into account the specifics of the industry.

- **Engineering consulting, calculations and modeling problem-solving.**

In some cases a customer lacks manpower or brainpower for fully utilizing the potential of a CAE solution it uses for design and simulations. In this case we are ready to offer a range of services concerning task formulation, developing a model, choosing of a solver, and modeling itself using Fidesys cores or other software. We suggest a development of a custom-made module that will solve a specific simulation problem for a client.

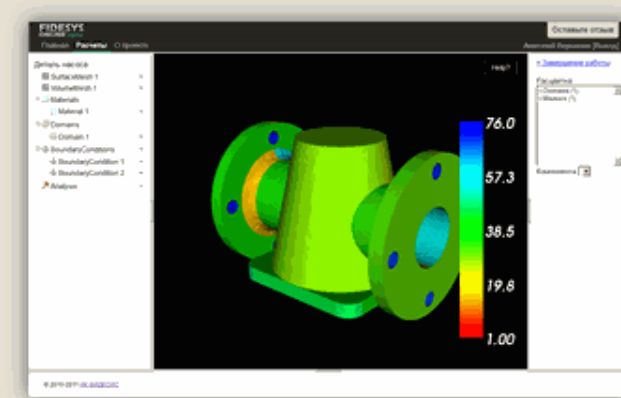
Project status

- IP protected in Russia.
- Completed engineering consulting projects using our own software: Rosatom, Sibur – Russian Tyres, Rosnano.
- Residents of Skolkovo Innovation Centre.
 - <http://community.sk.ru/press/b/pressabout/archive/2011/08/30/skolkovo-to-learn-strength.aspx>
 - <http://www.sk.ru/en/Community/Participants/IT/StrategBezobas.aspx>
- Attracted Round A from a Russian business angel and Skolkovo fund (co-financing agreement) in August 2011: \$1,1 mln for R&D.
- <http://www.cae-fidesys.com/en>

Добро пожаловать в ФИДЕСИС Онлайн!

Сервис ФИДЕСИС Онлайн позволяет провести расчет напряженно-деформированного состояния тела при статическом нагружении. Для проведения расчета Вам требуется только веб-браузер и подключение к Интернет. Теперь провести расчет детали на прочность стало просто как никогда.

1. [Зарегистрируйтесь](#).
2. Загрузите модель.
3. Постройте конечноэлементную сетку.
4. Задайте нагрузки и закрепления.
5. Запустите расчет.
6. Дождитесь окончания расчета.
7. Проанализируйте результаты.



**Доступно с любого
устройства**

Сервис доступен из любой

**Минимальные
требования**

Все расчеты производятся в

**Проверенный метод
расчета**

Для расчетов используется

Contacts

Fidesys LLC

Address:

119991, Russian Federation, Moscow,
Leninskie gory, 1/77, Science park of
Lomonosov Moscow State University

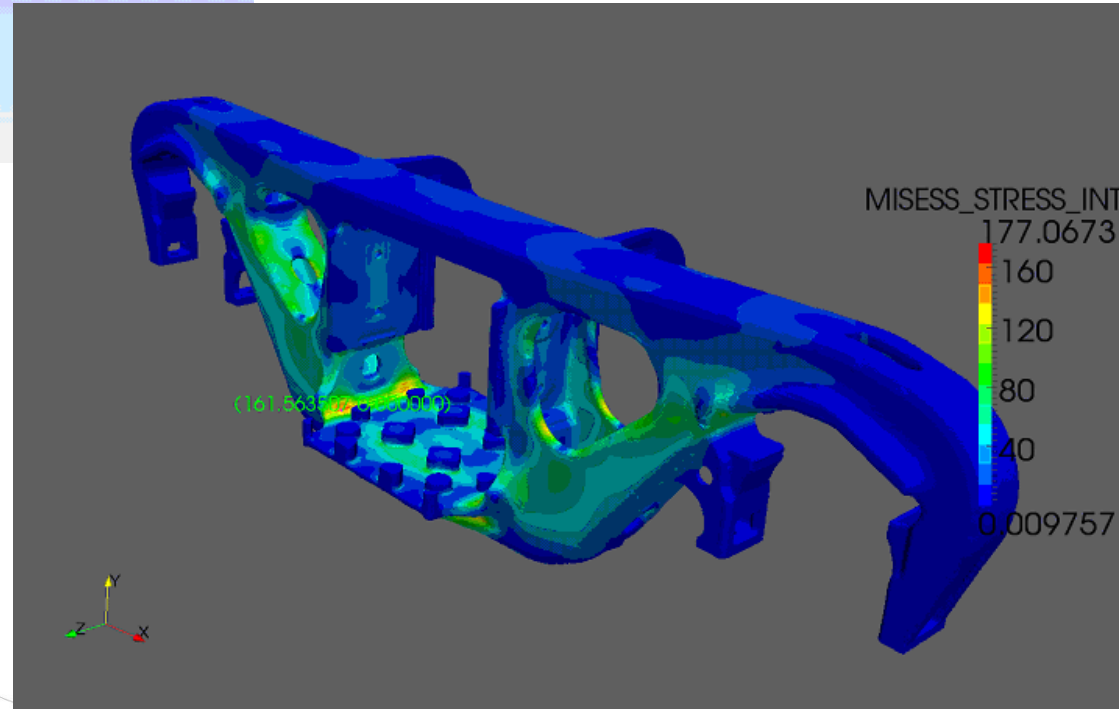
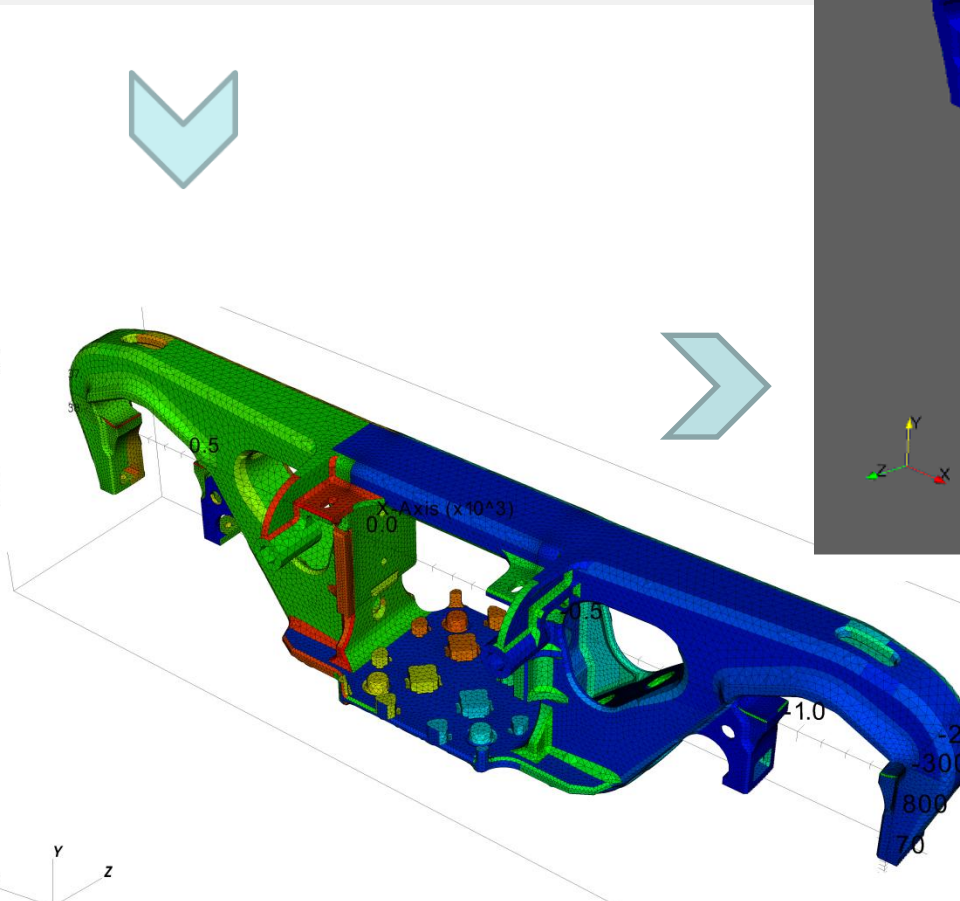
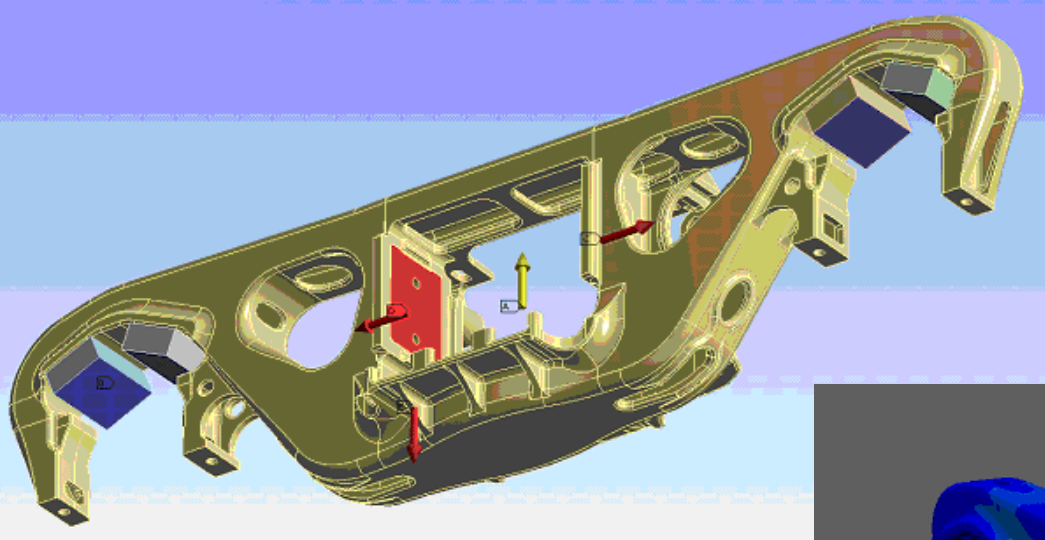
Phone: +7 (495) 930-87-53

Email: contact@cae-fidesys.com

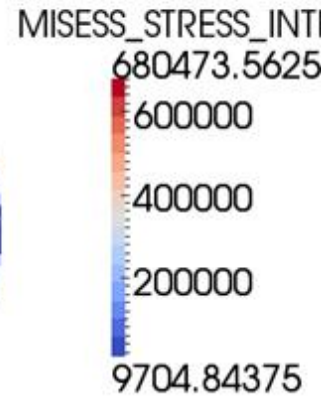
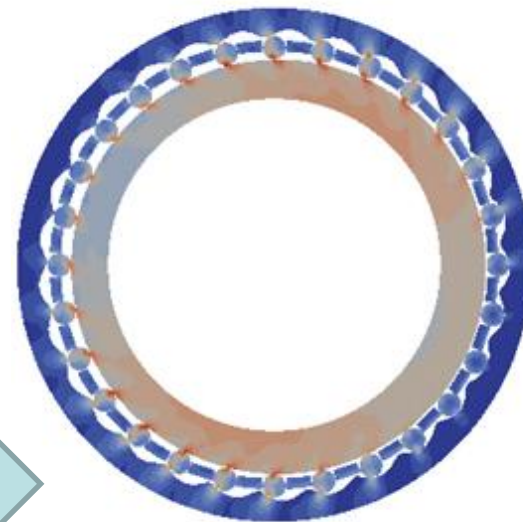
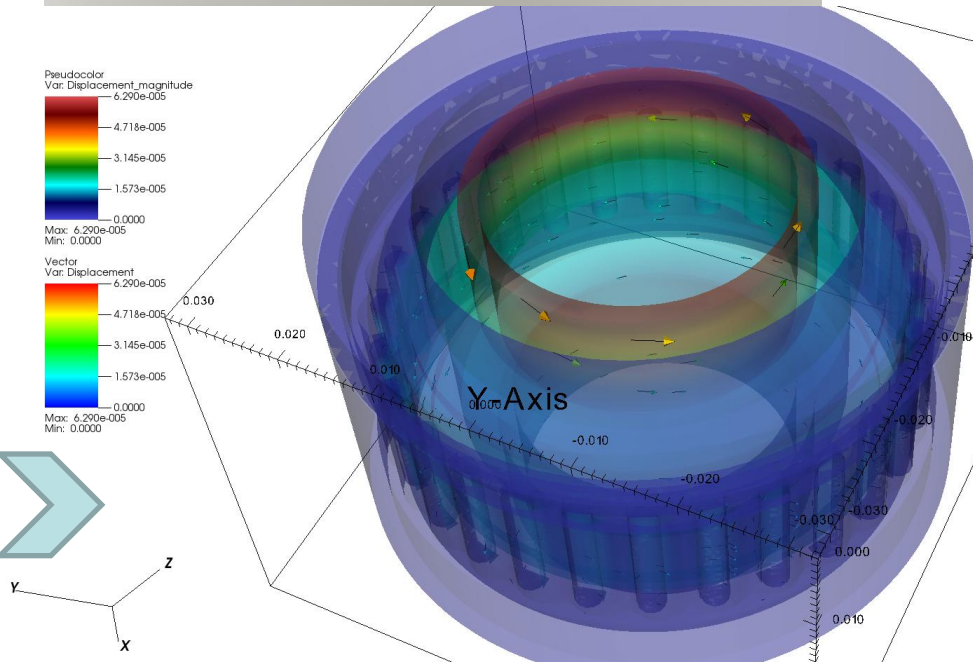
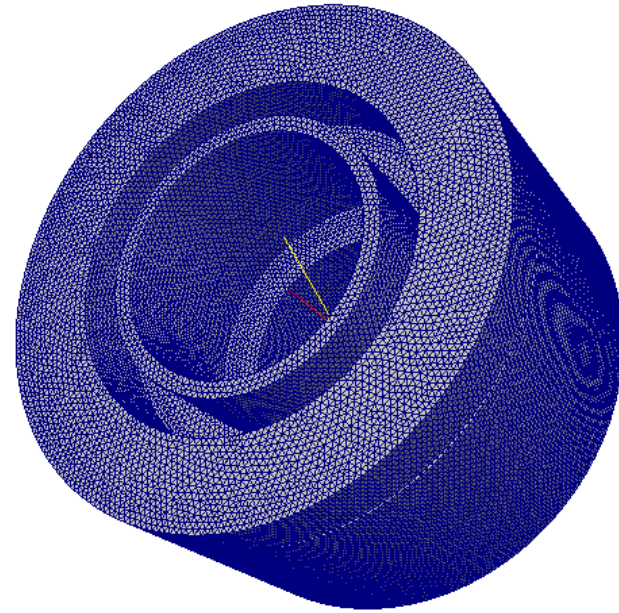
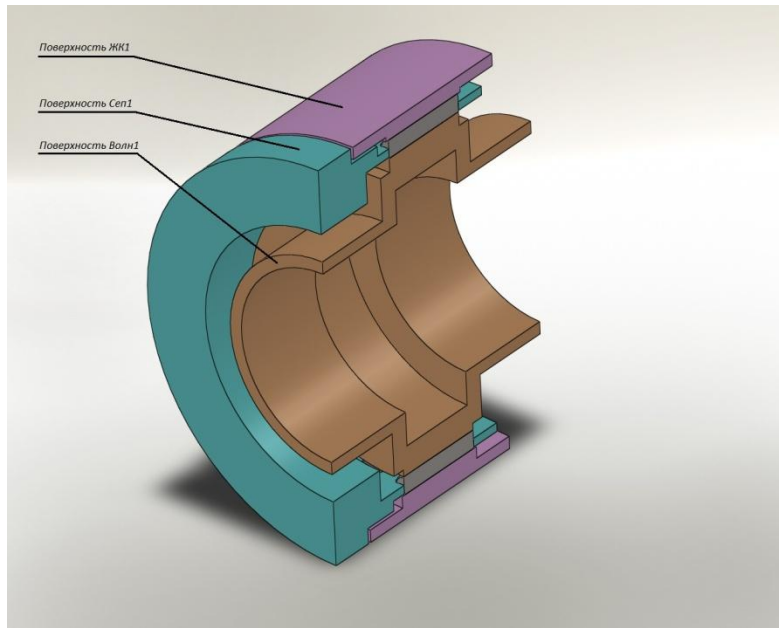
Web: <http://www.cae-fidesys.com>

EXAMPLES

Railway wheel's side

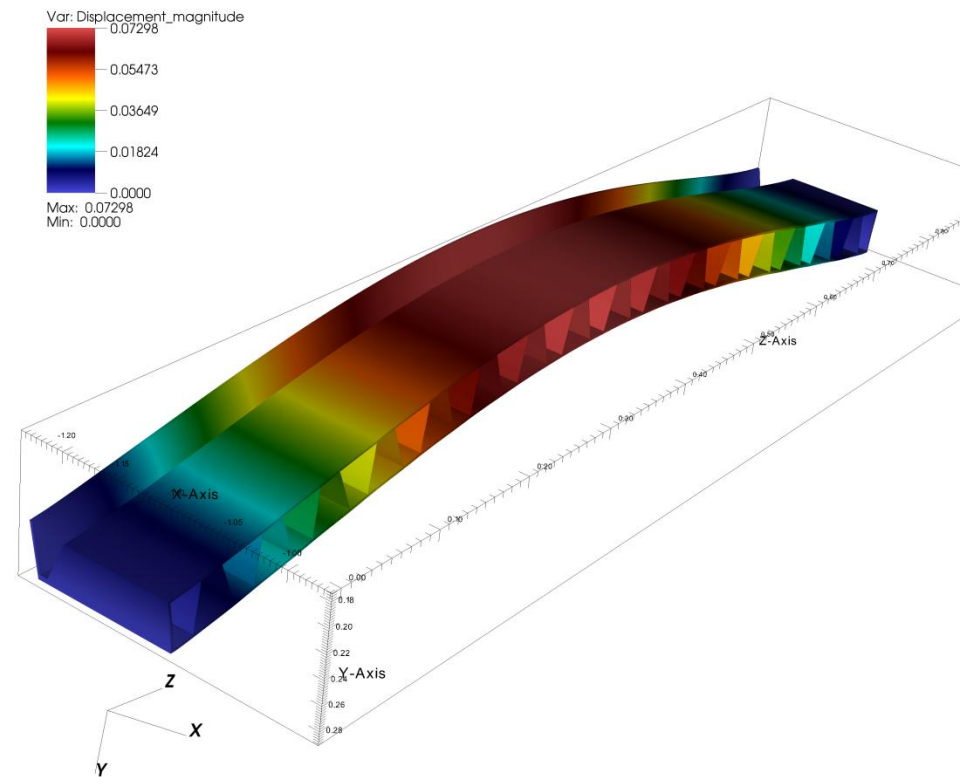
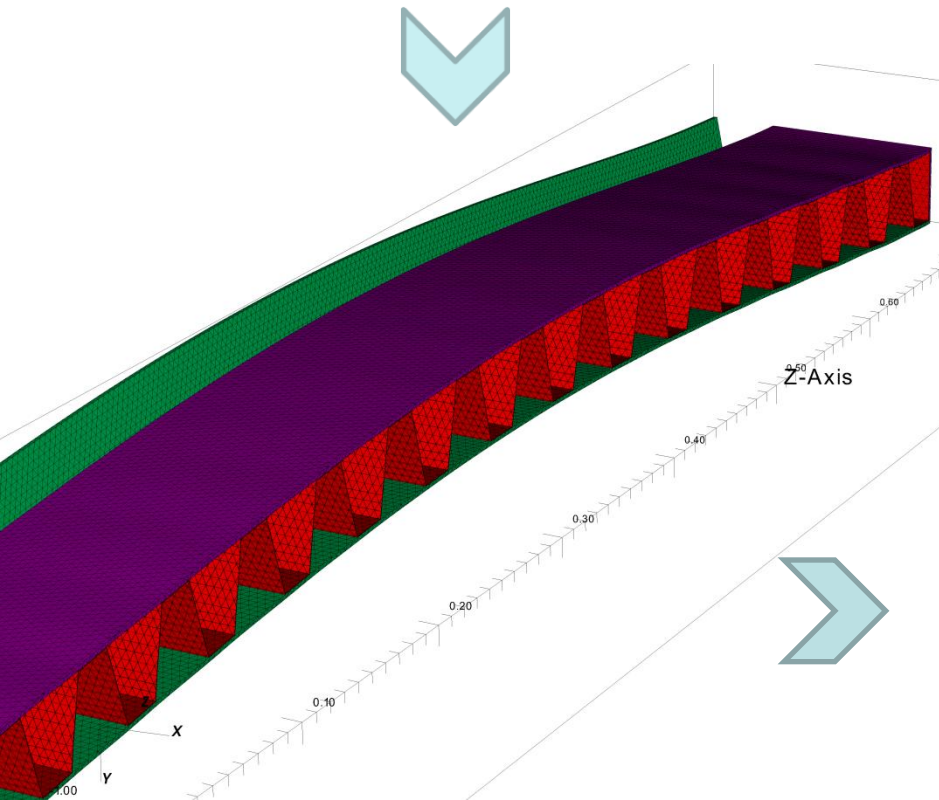
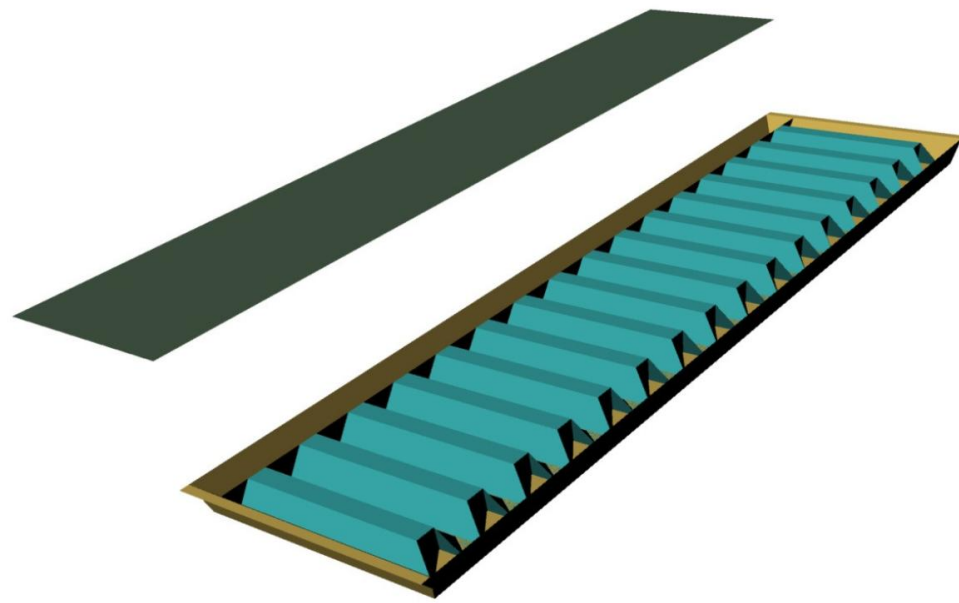


Stress/strain analysis of mechanical reductor

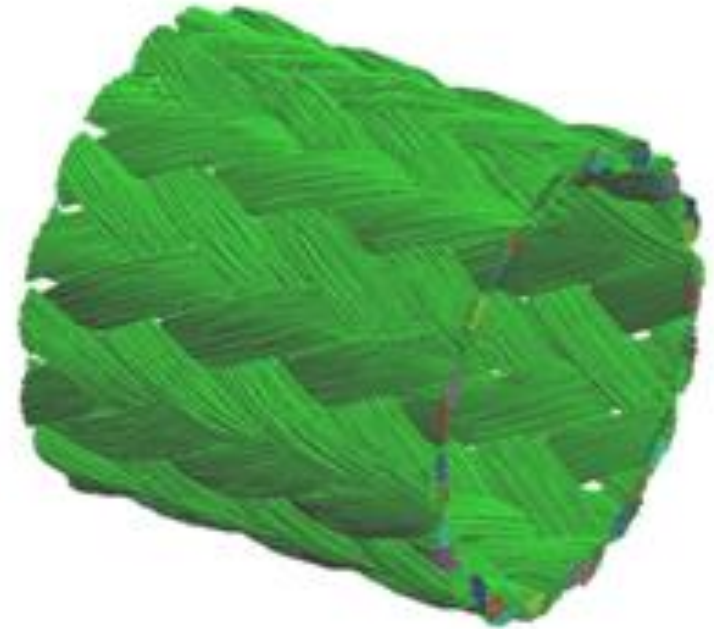
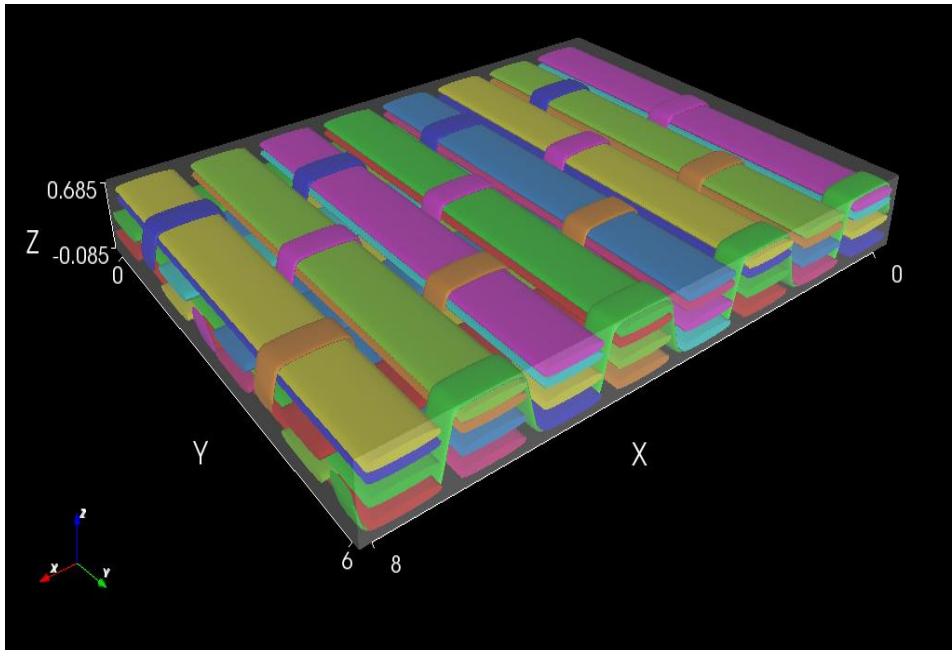


Pedestrian bridge

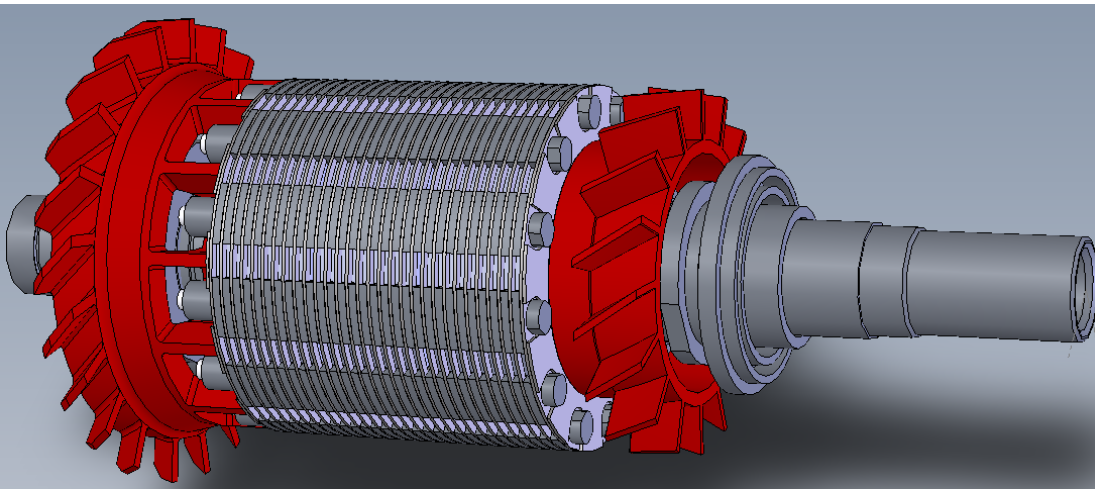
The structural modeling of a pedestrian composite bridge. The shear plies are there to transfer the load between top / bottom laminate. Different types have been calculated for deflection of the construction in order to determine the best with minimal deflection.



Modeling of composites

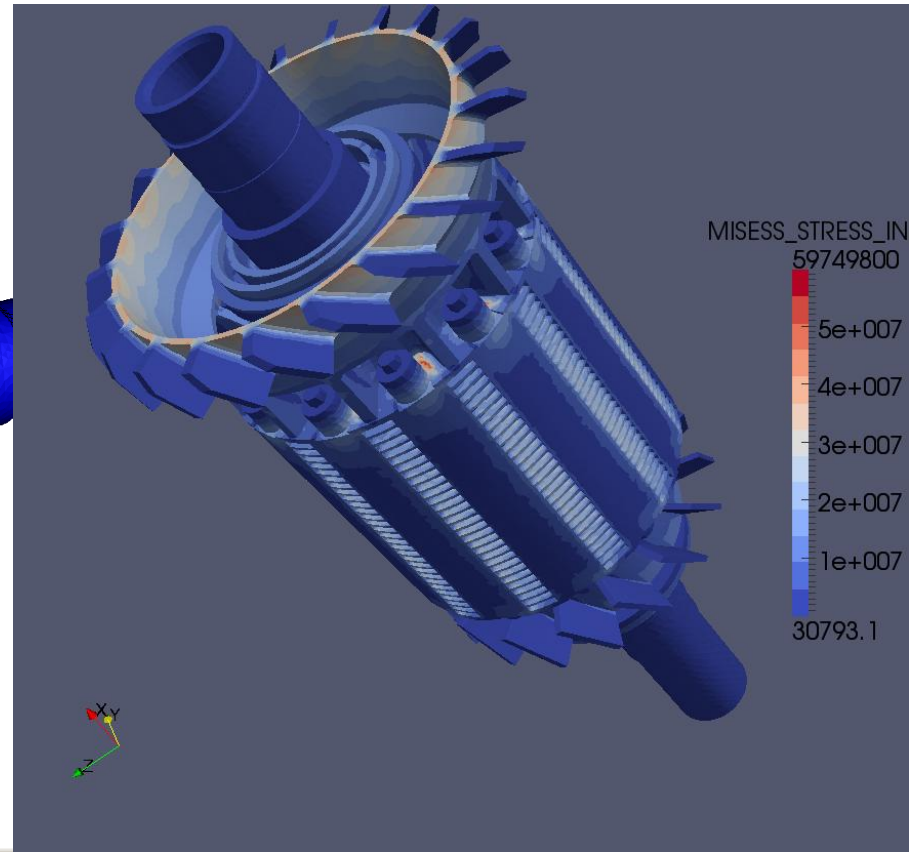
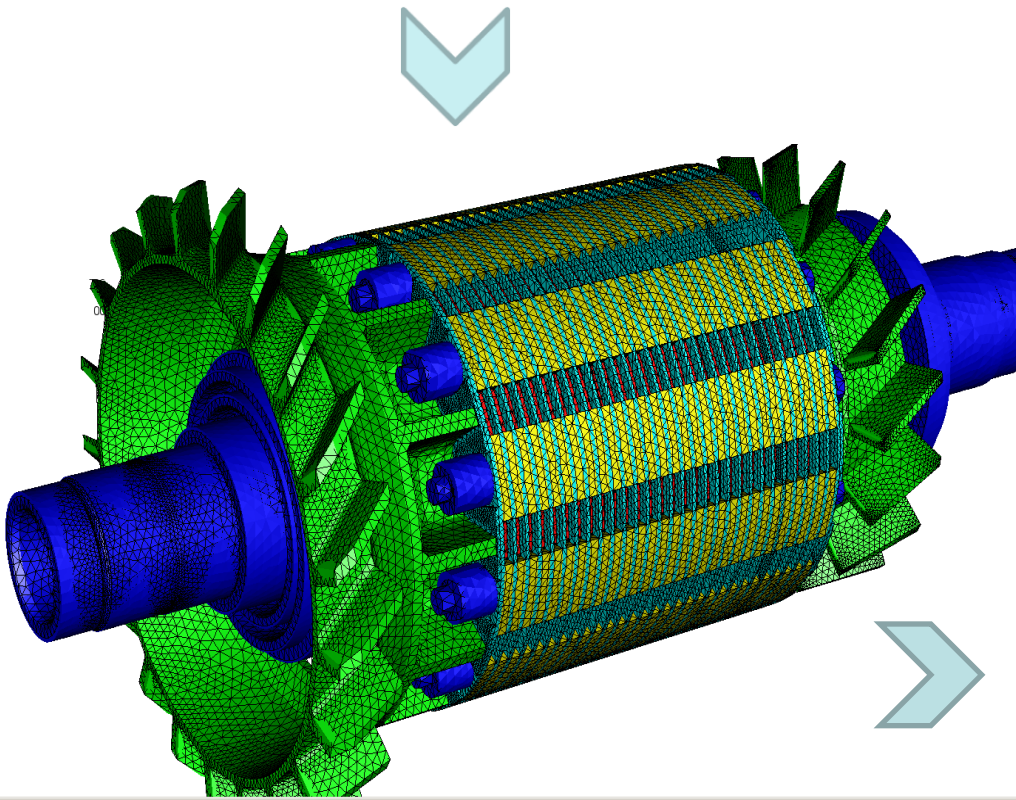


- Mechanical and mathematical models for computer simulation of composites and tools made of them with nonlinear behavior
- Models' specification for textile composites taking into account properties of armor threads and matrix
- Effective properties for periodic cells
- Micro structural description and modeling of composite solids



Rotor modeling

Computer modeling of a dynamical deformations of rotating compound model. Eigenfrequencies analysis for the determinations of the resonance frequencies of rotor and their possible coincidence with the working rotational frequencies.

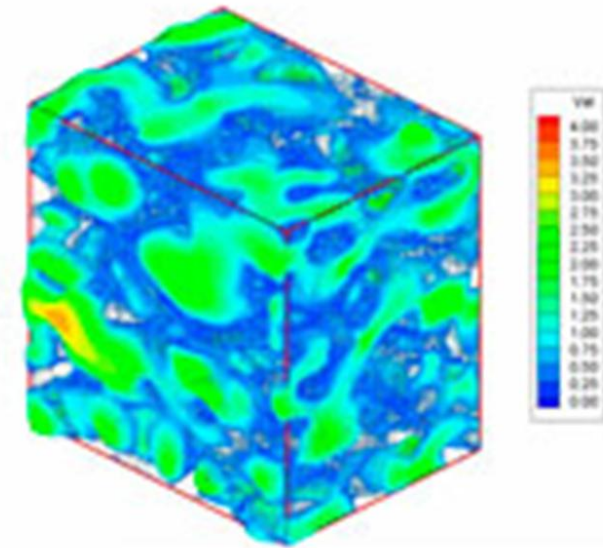


Modeling of cellular foam concrete.

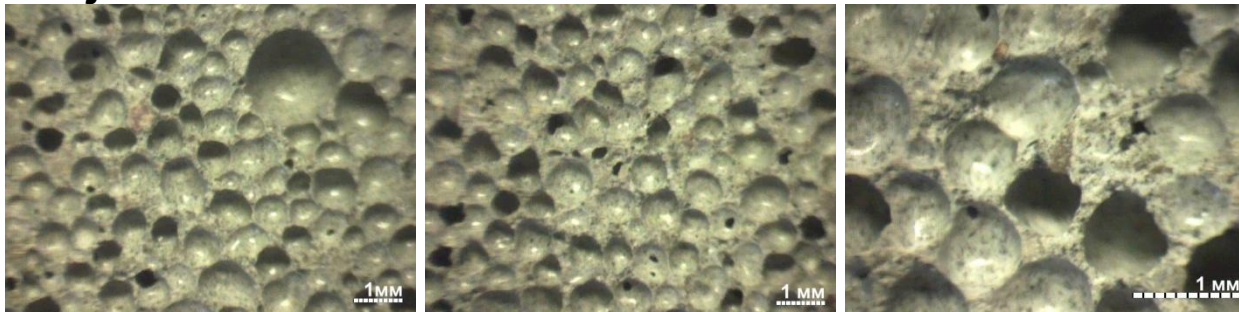
Customer: Maximus LLC

Problem: computer simulations of mechanical loadings of cellular foam concrete under uniaxial compressive and flexural forces in order to determine effective properties of the sample for the study of foam concrete blocks.

The analysis of the stress-strain state of foam concrete blocks was done. The effective elastic moduli of the porous foam were obtained. Based on these parameters the strength criteria fulfillment was checked for the foam of varying porosity. The problem was solved on a MultiGPU hybrid cluster.



Project was finished in 2011.



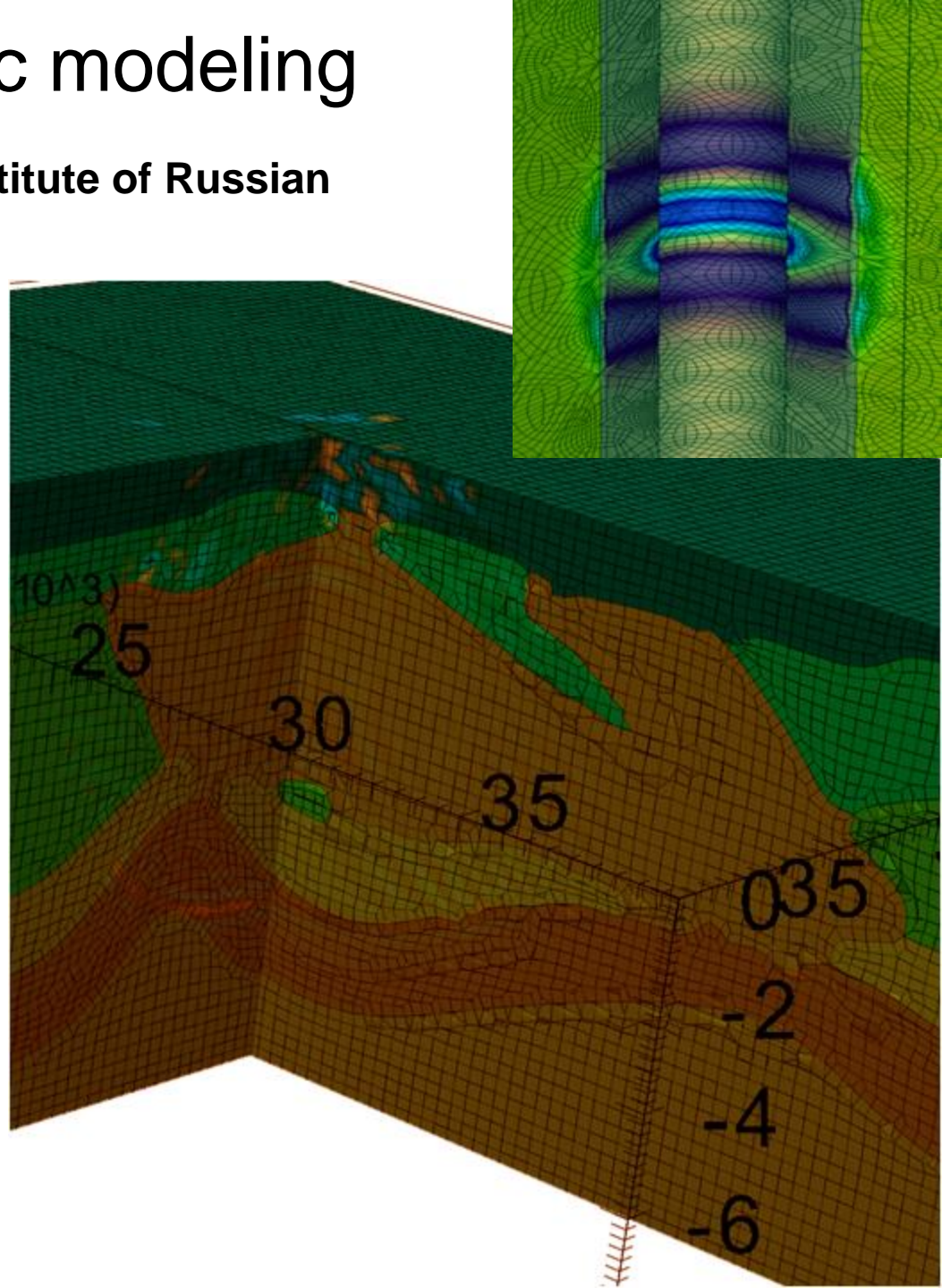
Acoustic & Seismic modeling

Customer: Research geophysical institute of Russian Academy of Sciences

Problem: Acoustic logging. Modeling of waves propagation along the borehole requires a tremendous amount of computational resources in order to properly describe a highly-dispersive Stoneley wave.

Applied methods of solution:
High-order tensorized discontinuous Galerkin method in space and 3rd order Runge-Kutta in time. Unstructured hexahedral meshes were used.
Implementation is done on a massively-parallel MultiGPU platform based on 4xFermi cards.

Project was finished in 2010



Tyre Modeling

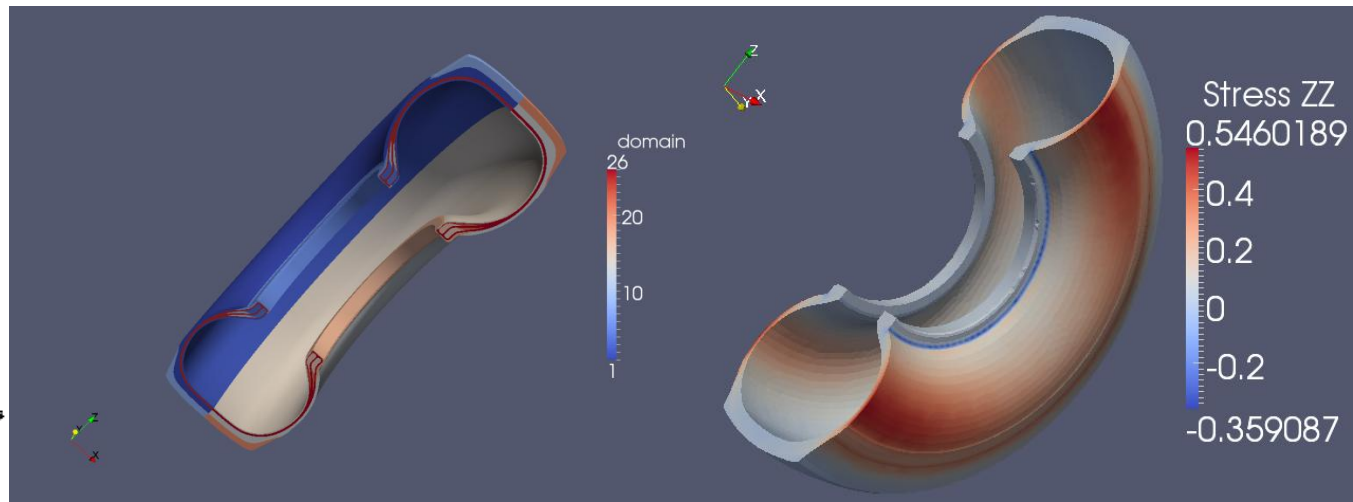
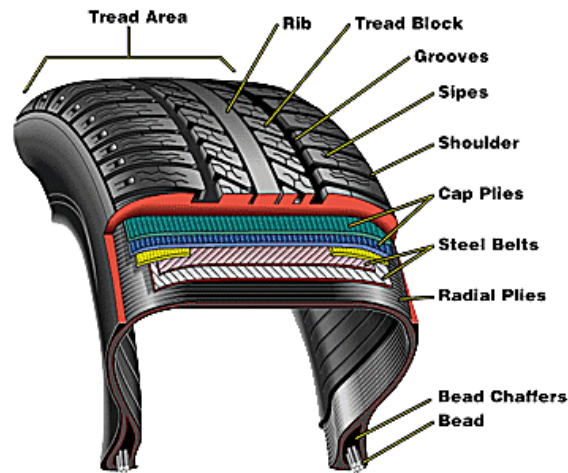
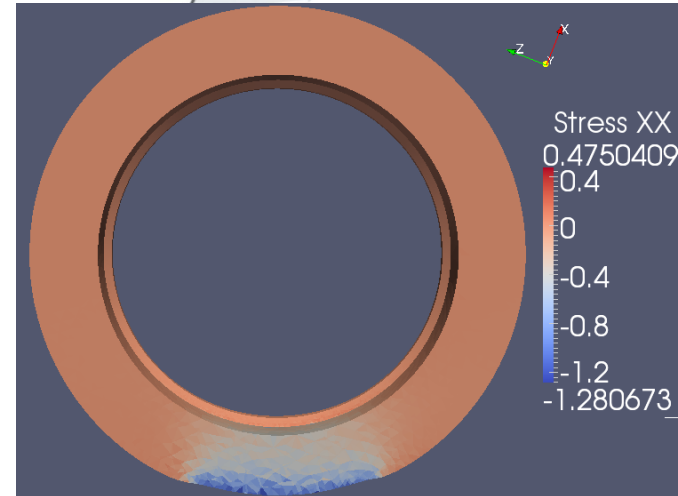
Customer: Research Institute of Tyre Industry

Problem: Determination of the contact shape between a tyre and a plane surface which is required for the problem of aquaplaning.

Applied methods of solution :

A given CAD-model was processed by means of CGMA-OpenCascade library and rotated in a final 3D model which was adaptively meshed by means of Ani3D library. Nonlinear FEM3D solver was applied further for solving a strength problem under finite strains for totally incompressible material – a modified mixed formulation on a staggered grid. A saddle system solver implemented on Fermi platform using CUDA was applied in order to determine a solution.

Project was finished in 2010.



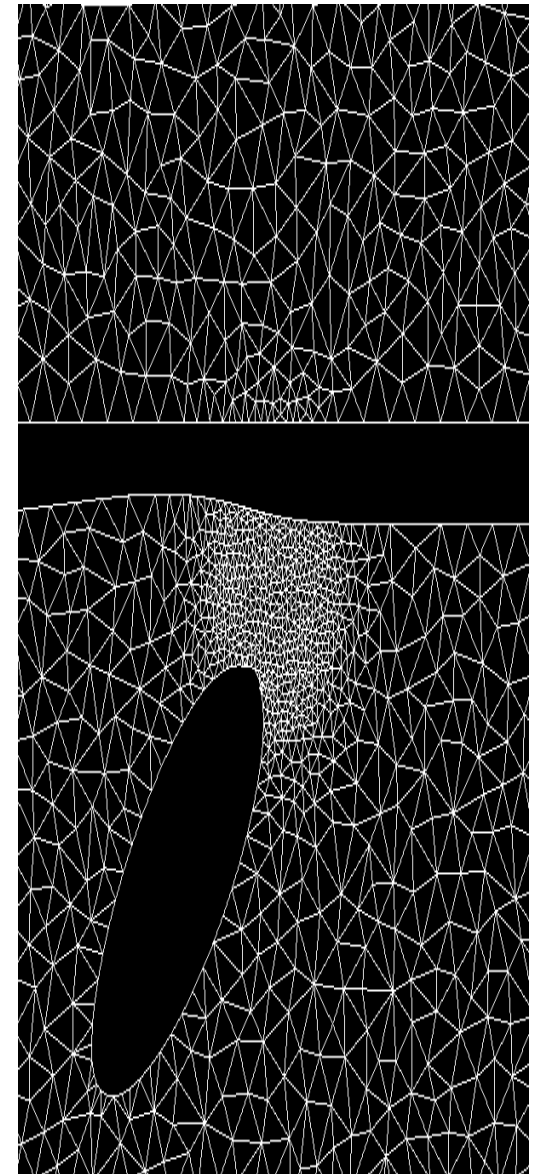
Hydrocrack propagation

Customer: Gubkin oil and gas institute

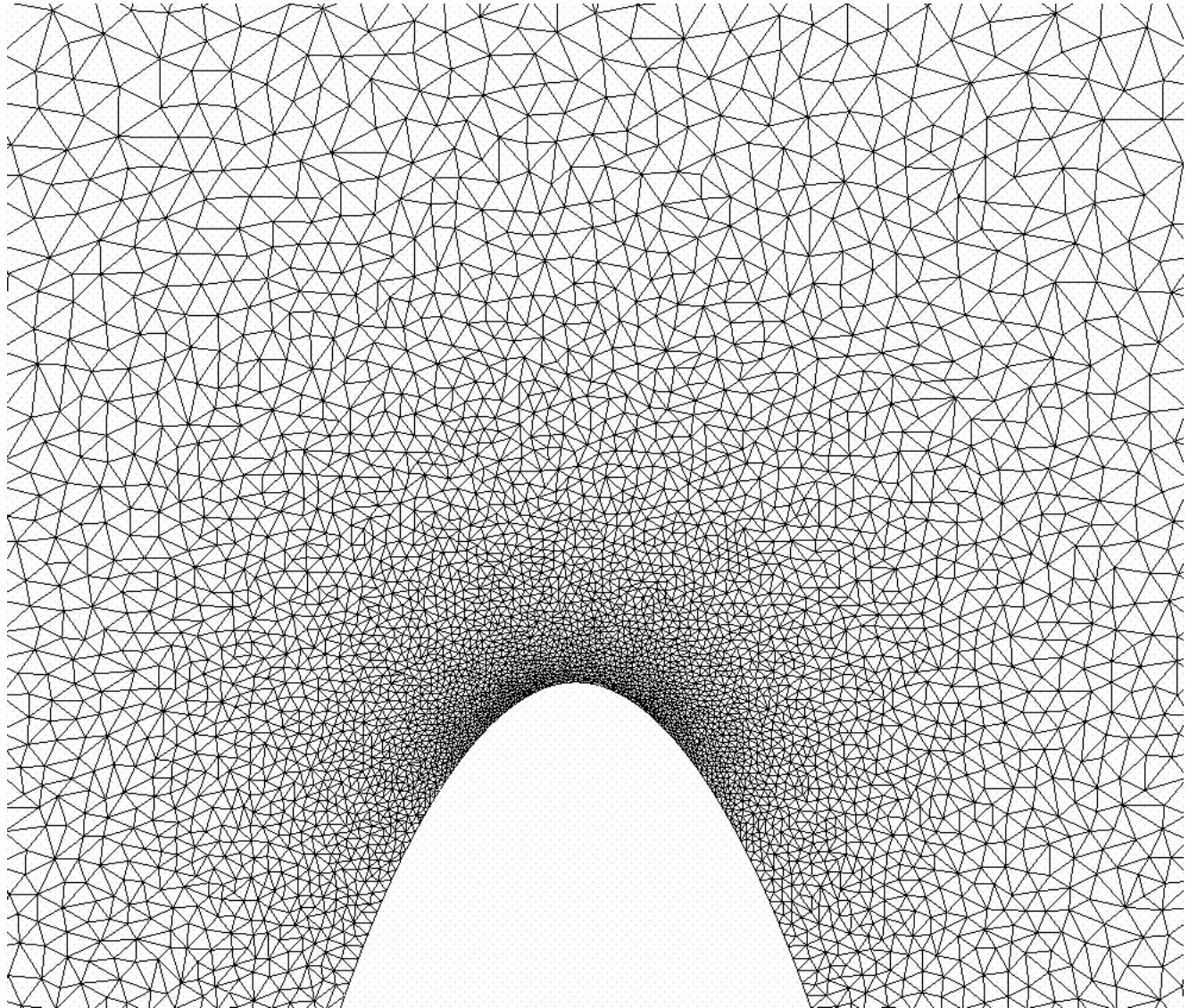
Problem: 2D modeling of a hydrocrack propagation and its interaction with a layers' discontinuity. Hydrocrack development is caused by an internal pressure due to pumped in proppant. Nonlocal strength criteria is used in the vicinity of the crack's tip in order to properly describe a process of a carbonate's destruction.

Applied methods of solution: CUDA implementation of the finite element method on unstructured adaptively reconstructed grids coupled with the nonlocal strength conditions. Contact problem for the interaction between layers' discontinuity and a hydrocrack. The problem was solved in a full formulation on 2xTesla C1060.

Project was finished in 2009.



Stopping of a Crack Growth



Models of Phase Transitions at Large Strains

Features of the model of phase transitions

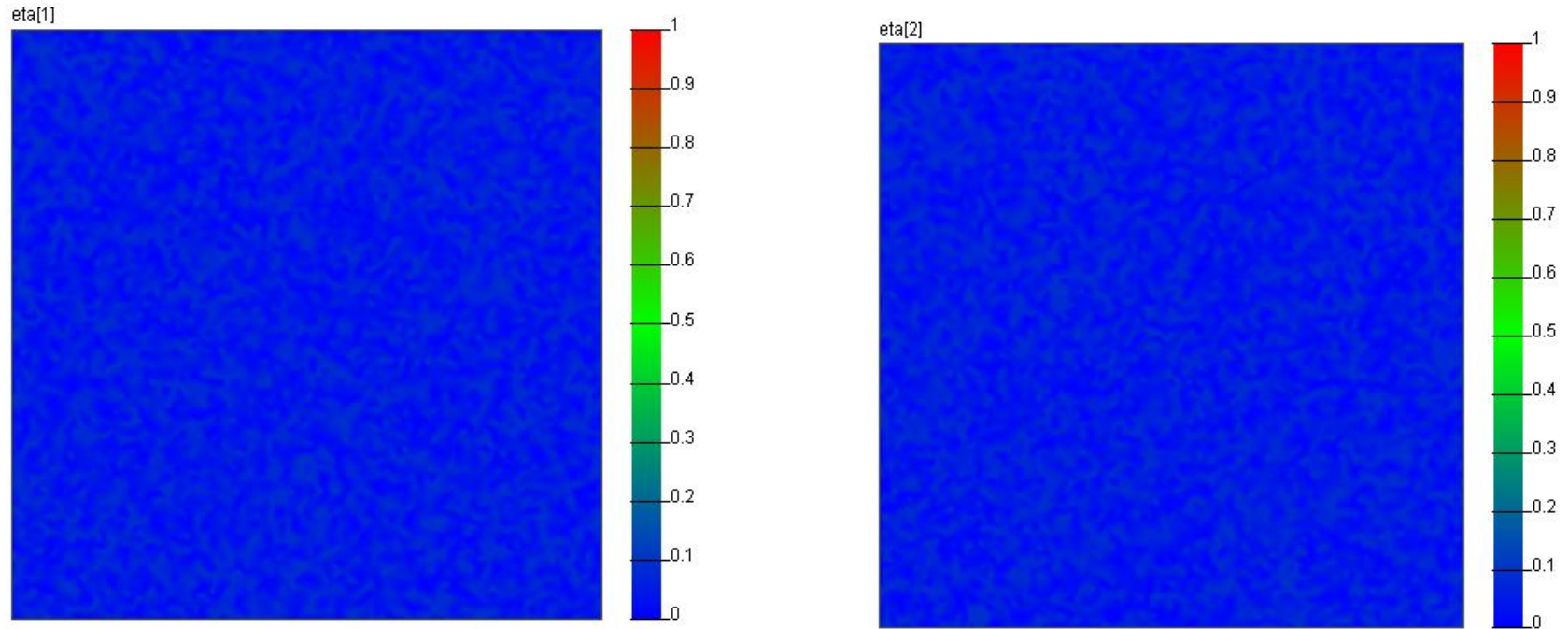
- Solids
- At constant temperature
- Under mechanical stresses
- Subject to proper deformation
- At finite strains (subject to their redistribution)
- Subject to gradient effects
- Multi-component order parameter

Based on work by V.I. Levitas, V.A. Levin, K.M. Zingerman, E.I. Freiman. Displacive Phase Transitions at Large Strains: Phase-Field Theory and Simulations. //Physical Review Letters. 103, 025702 (2009).

Virtual Journal of Nanoscale Science & Technology (American Institute of Physics, American Physical Society July 20, 2009 <http://www.vjnano.org/>

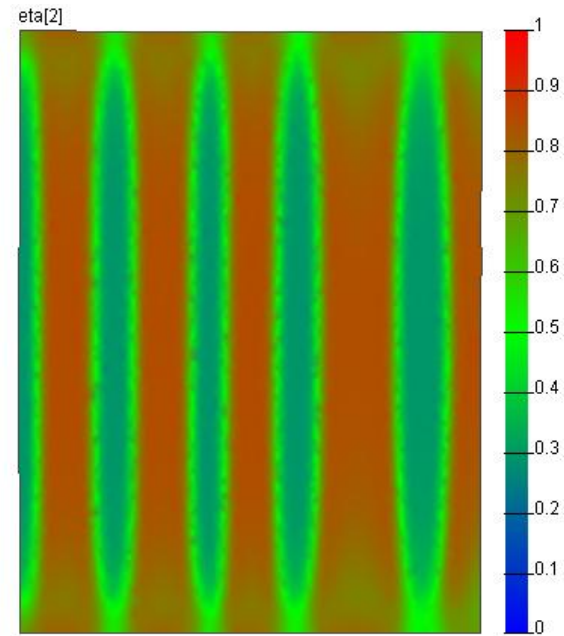
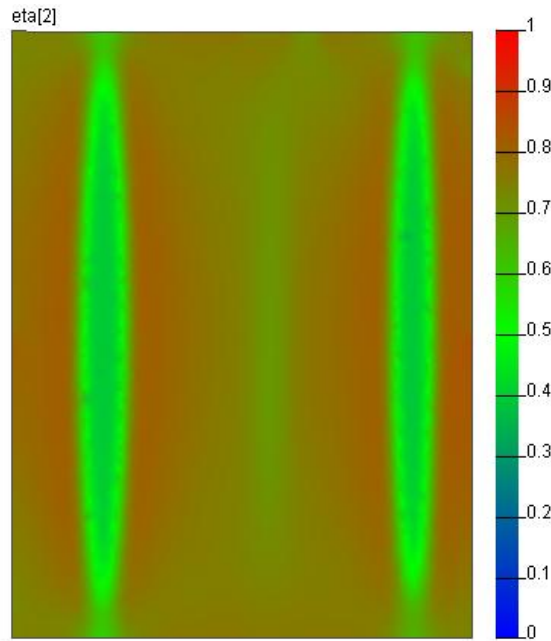
Example Problem

(origination of a structure under shear loading)



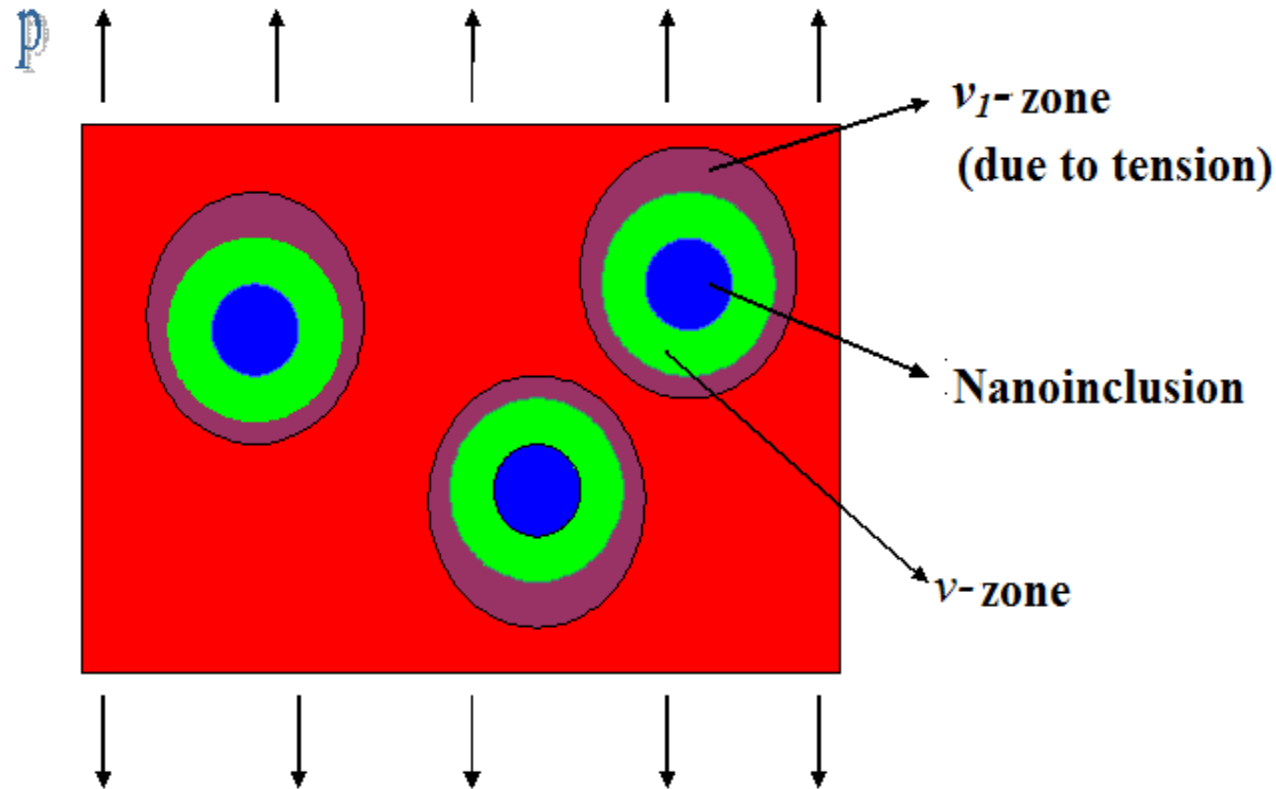
Distribution of the first (on the left) and the second (on the right) order parameters at the initial moment

Example Problem (continuation)



Distribution of the first order parameter after steadying.
Linear (on the left) and nonlinear (on the right) solutions.

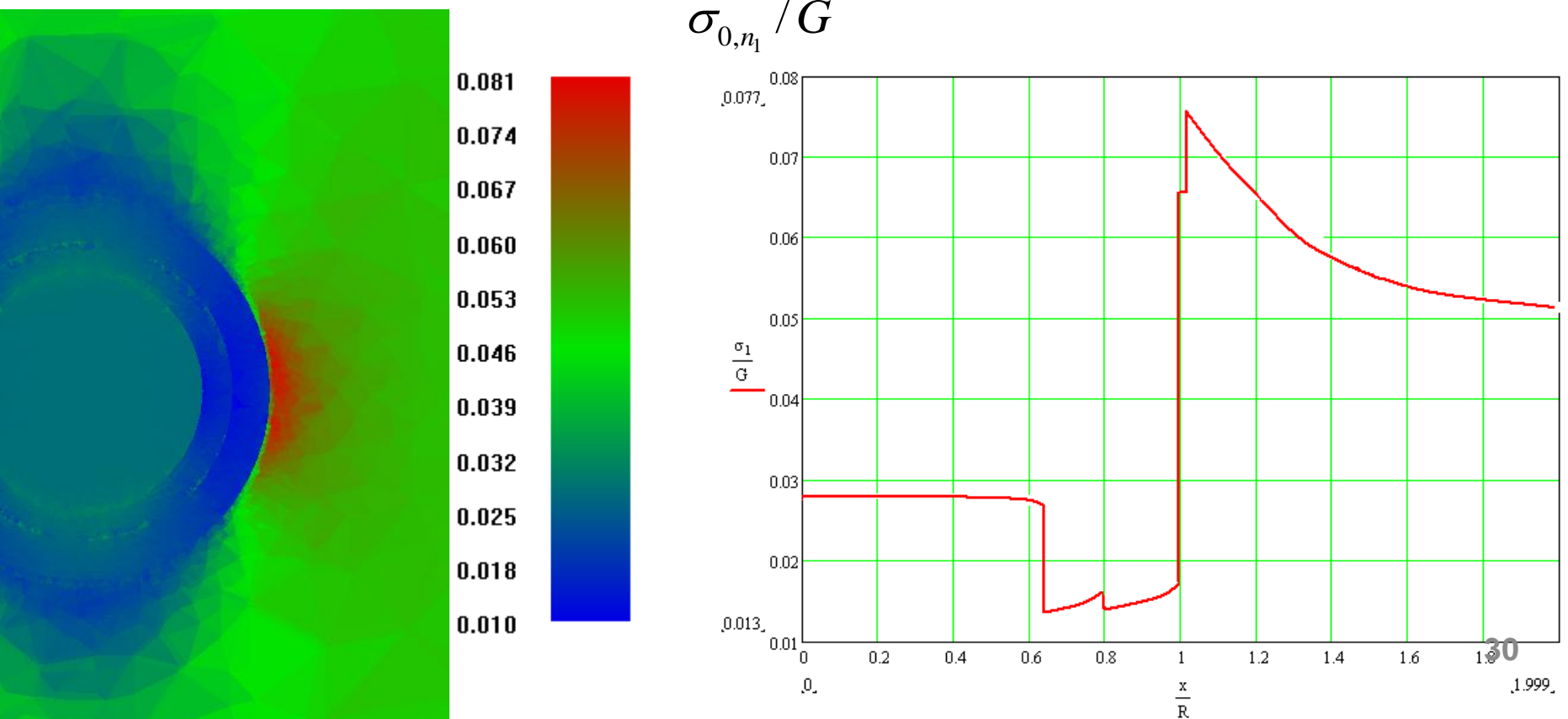
Models of Nano-Structured Material



Under loading an **additional zone** with changed properties, which is called a **prefracture zone**, appears around the inclusion (v -zone).

Consecutive Origination of Spherical Inclusions

A shape of the initial inclusion and its properties are given (i.e. properties of external layer), and then at each step of the process an interior domain is originated inside the previous one.



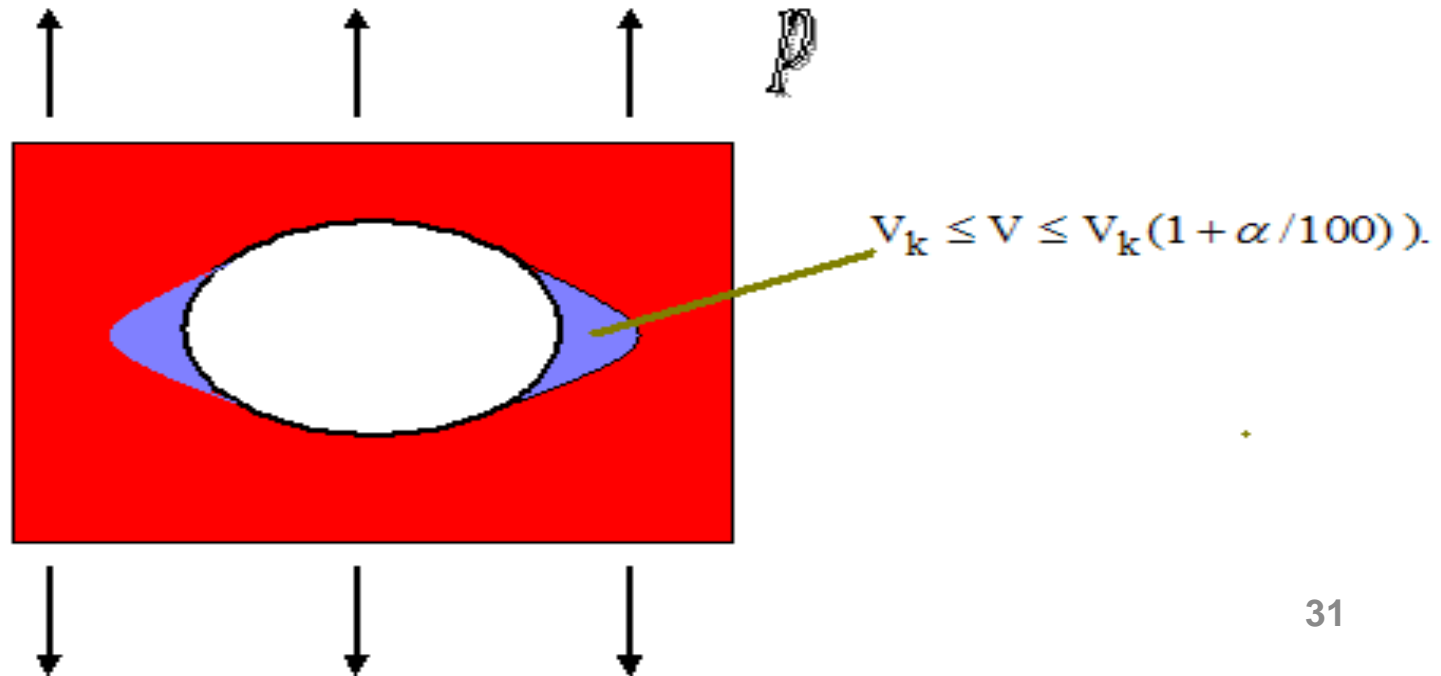
Model of a Defect Evolution.

Prefracture Zones.

The external load is applied (totally or particularly according to **the loading program**). Nonlocal criteria is performed (a variant of such criteria is shown on the following slides).

A prefracture region (**v-zone**) originates.

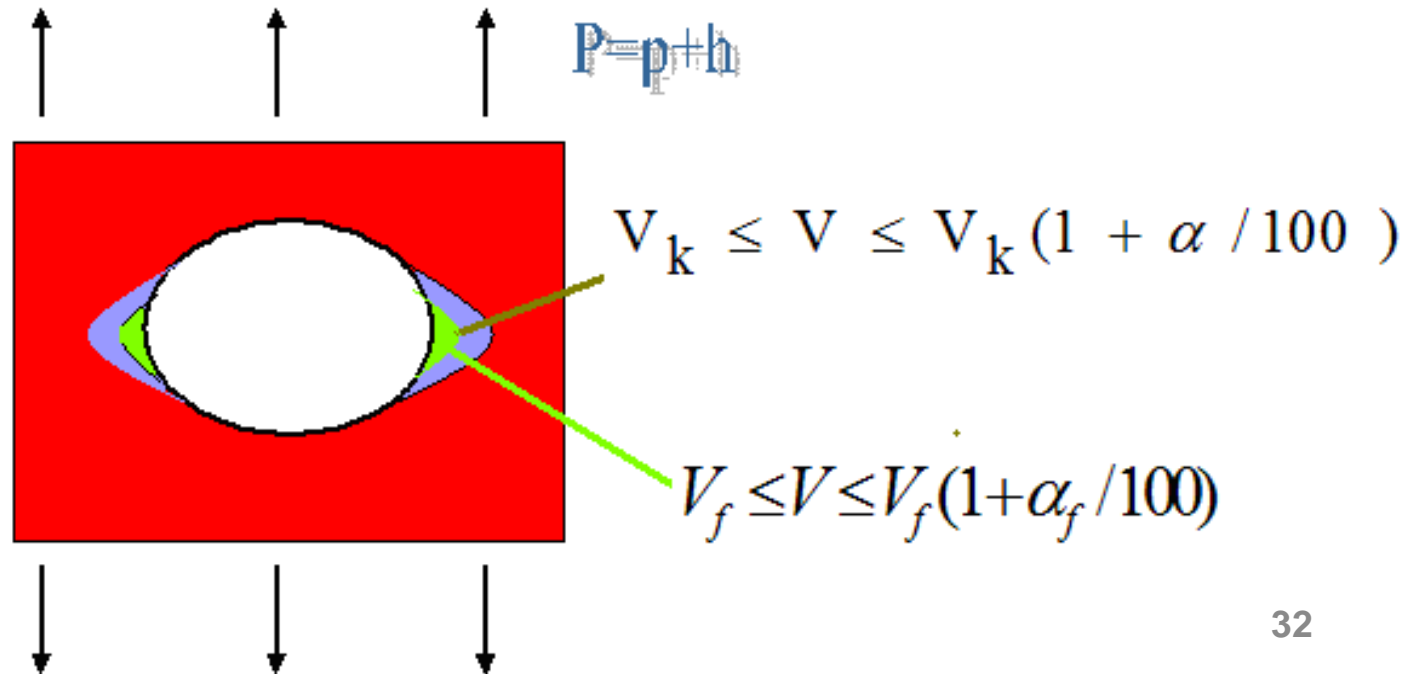
Its shape is determined by the criteria (by the isoline in this example).



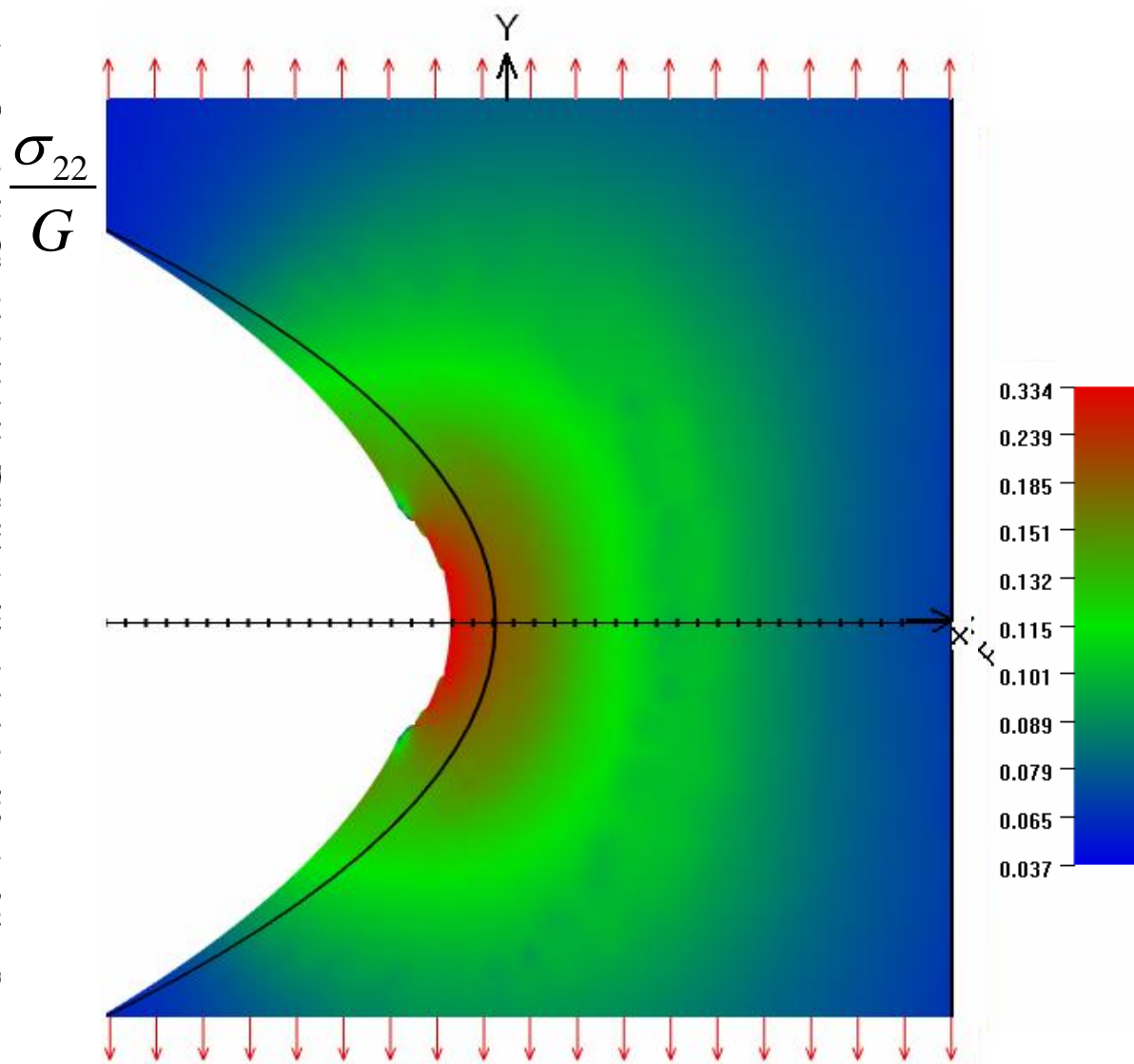
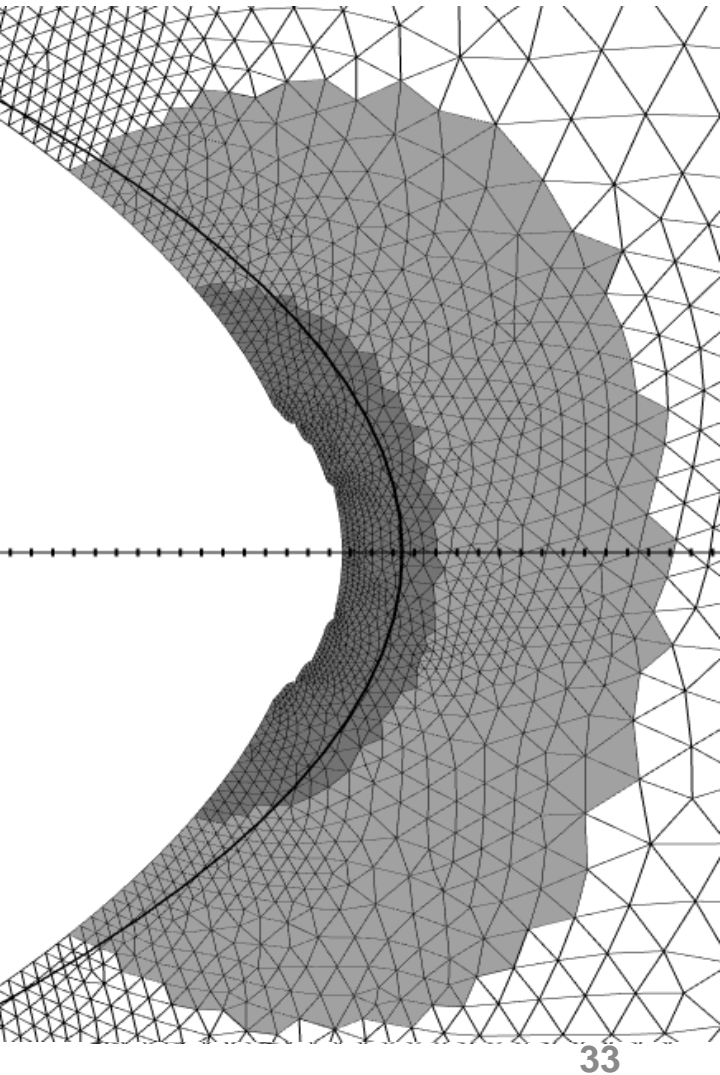
Model of a Defect Evolution.

Prefracture Zones.

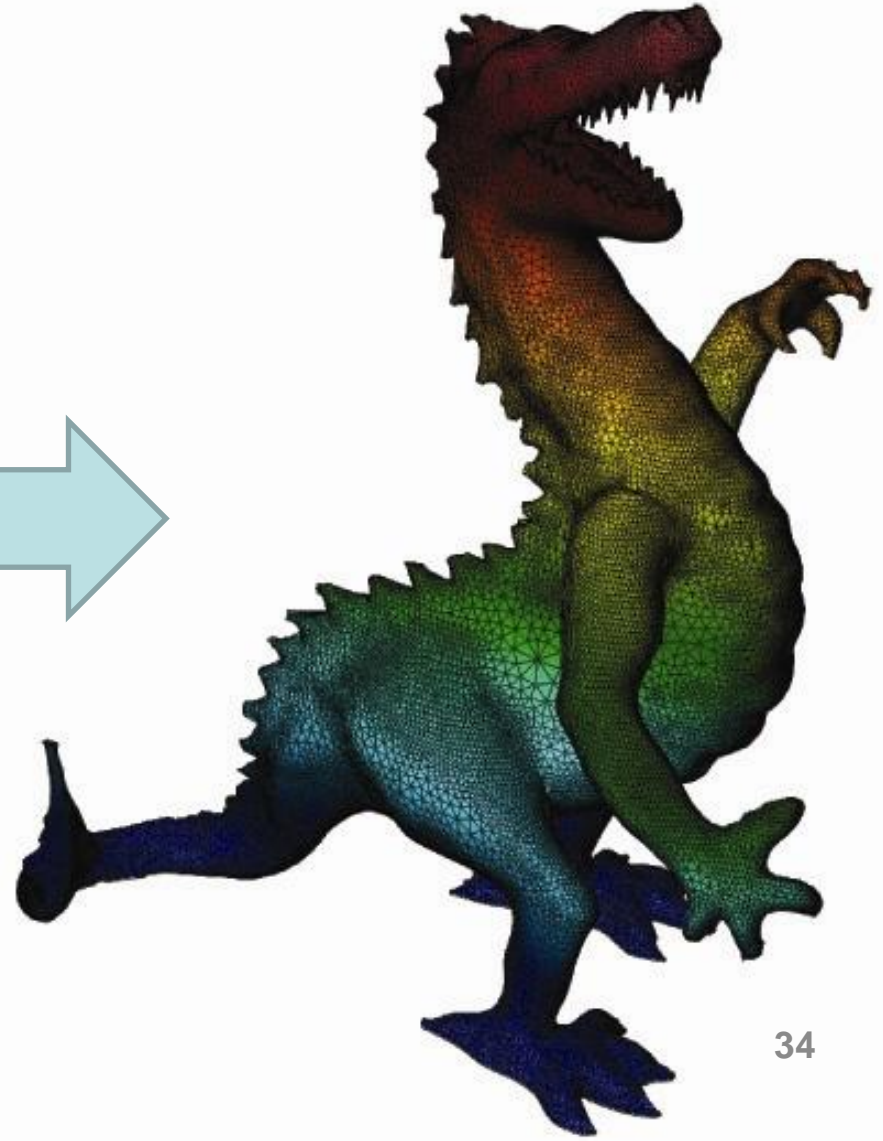
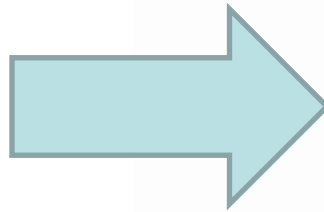
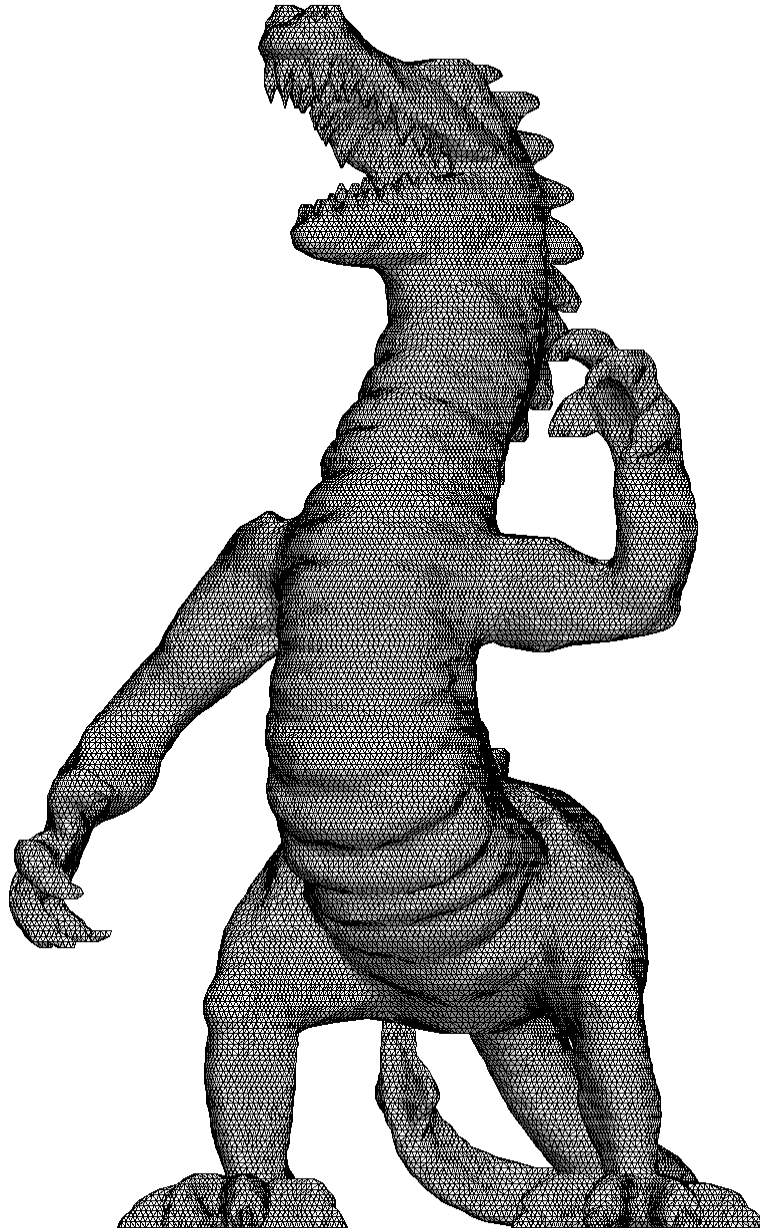
The external load is increased by some value h till $P = p + h$ (according to the loading program). Some nonlocal criteria is performed for the material of a prefracture zone. The second prefracture zone (**v-zone**) originates.



Example: Elliptic hole evolution



Improvement of 3D Meshes



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- V.A. Levin, K.M. Zingerman, A.V. Vershinin, E.I. Freiman, A.V. Kukushkin, A.V. Trachenko Development and use of the CAE-system "FIDESYS" for nonlinear analysis of solids with microstructure that changed during loading. IV European Congress on Computational Mechanics (ECCM IV): Solids, Structures and Coupled Problems in Engineering, Paris(France), 16-21 May 2010