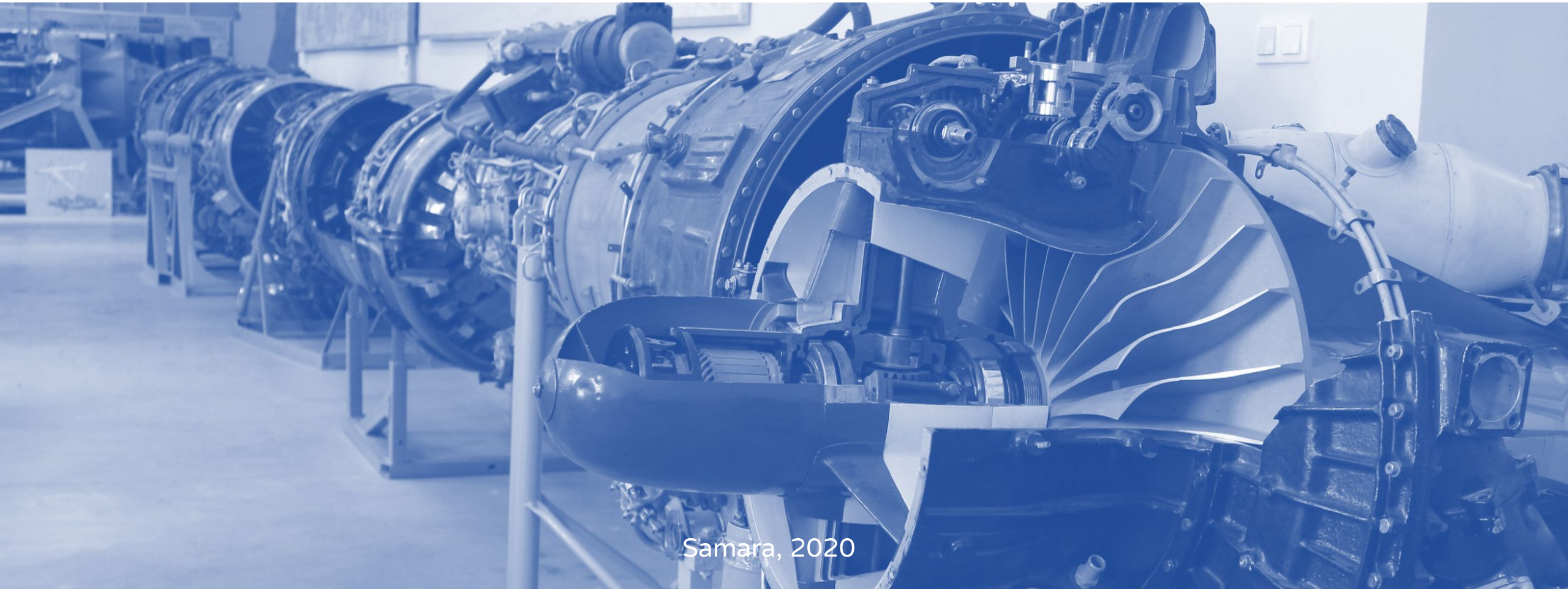
ИНСТИТУТ ДВИГАТЕЛЕЙ
И ЭНЕРГЕТИЧЕСКИХ УСТАНОВОК

Department of Aircraft Engine Construction and Design

«Aircraft engine and power plant engineering»
(program track 24.04.05 Aircraft engines)



Samara, 2020

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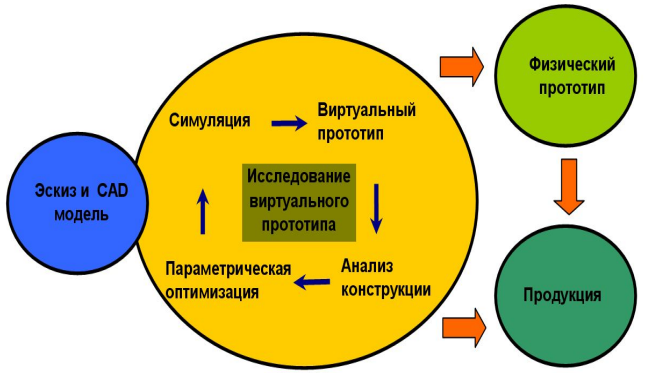
Master's major



Master's major:

- CAD/CAE-modeling
- Coupled calculations performing (gasdynamic, strength, vibration, thermal process, kinematics, tribology)
- Scientific research on modern problems of engine technology

Special aspects:

- Fundamental training intensification. Master's degree student – is an intended scientist at the university or a head of creative team at manufacturing.
- Research nature of studies and tasks.

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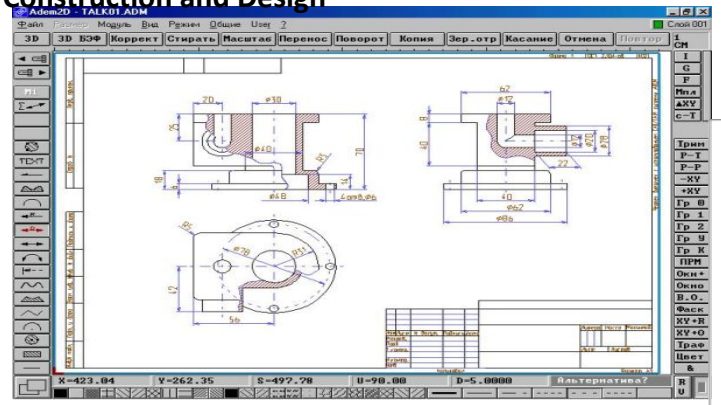
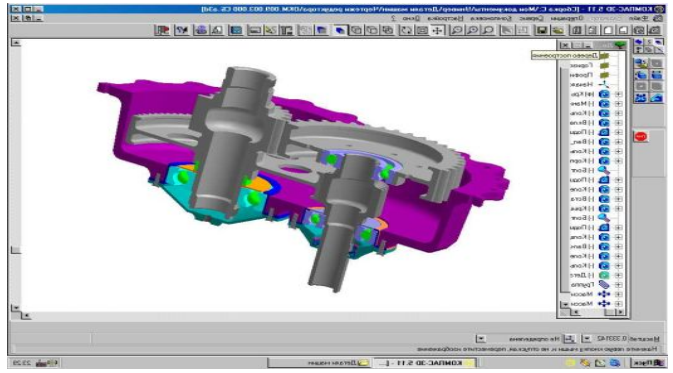
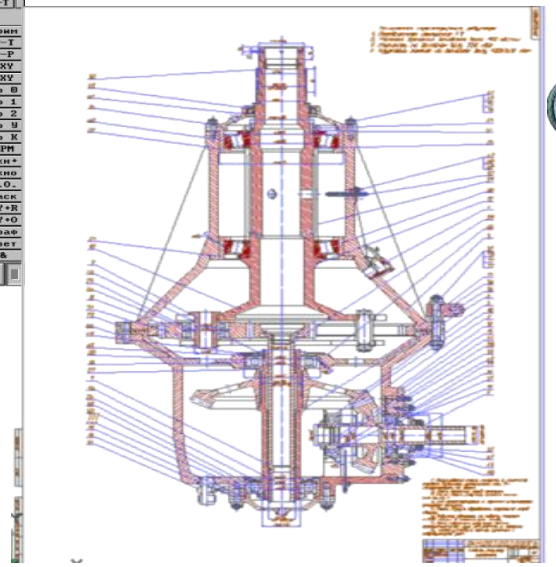
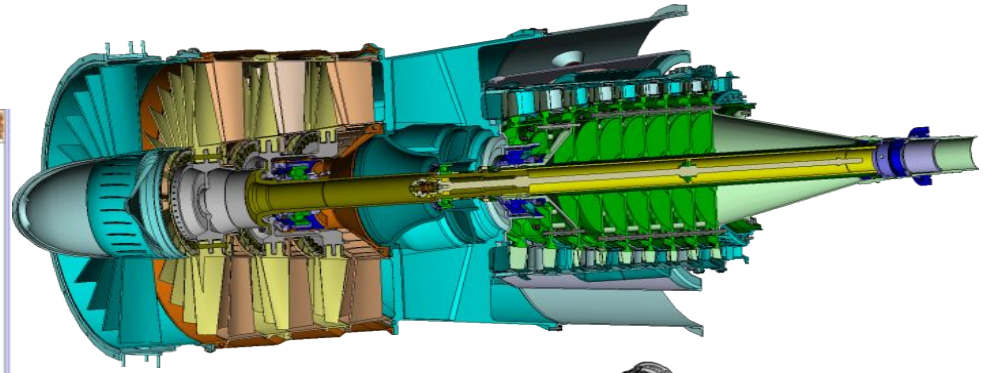
Educational process

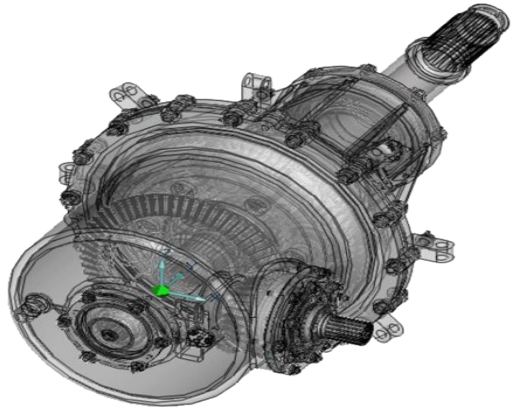
Project managment and integrated IT technologies in the field of engines and power-plants engineering











ADEM | KOMPAS 3D | SolidWorks | SolidEdge | NX (Unigraphics)

1 YEAR | 2 YEAR | 3 YEAR | 4 YEAR | **MASTER'S PROGR.**

Engineering

Machinery
The theory of machines and mechanisms

Aircraft engines and PP designing
CAD - technologies

Educational process

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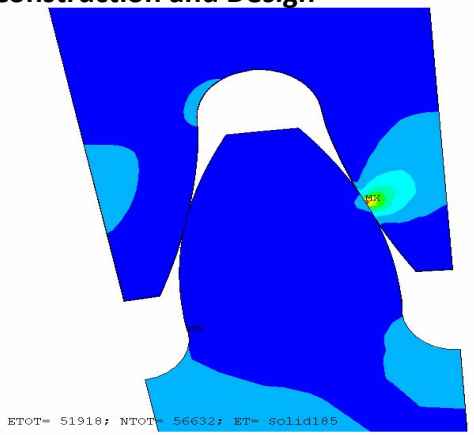
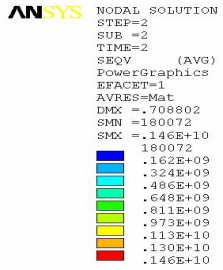
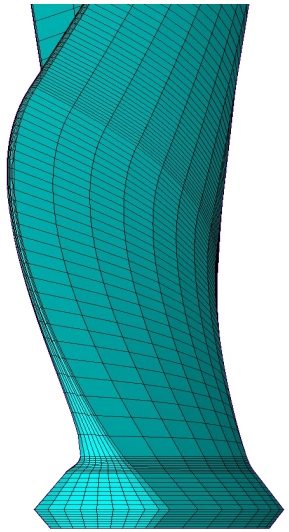
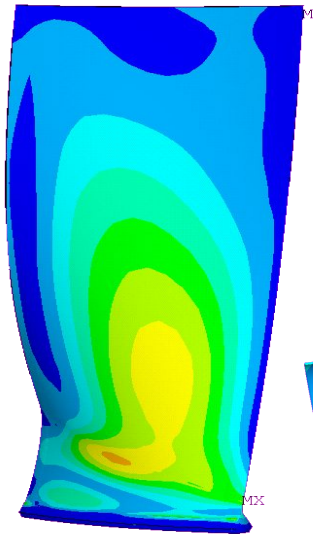
Department of Aircraft Engine Construction and Design

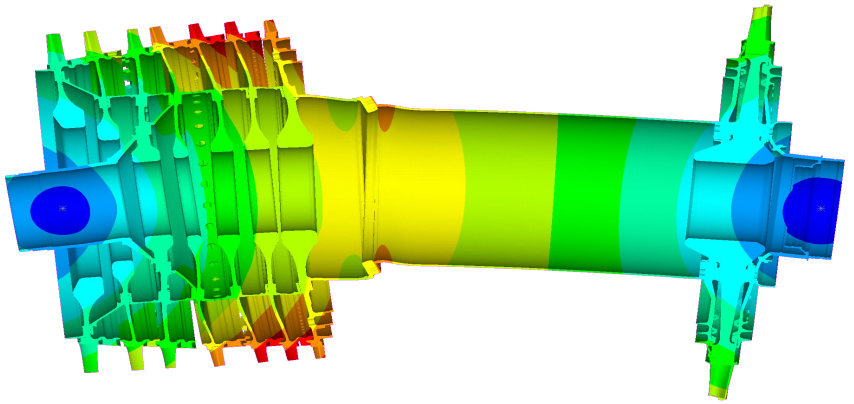




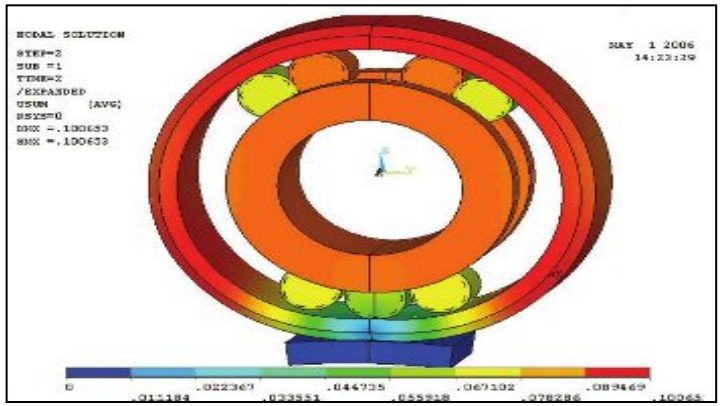


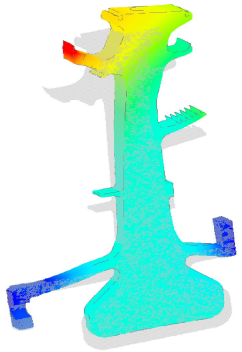


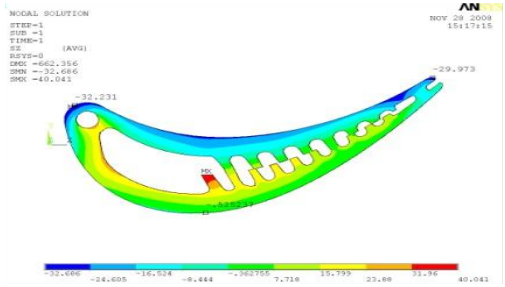
Calculation of blades



Oscilations of rotor







3 YEAR — Machinery

4 YEAR — Vibrations and strength analysis

MASTER'S PROGR. — Aircraft engines and PP designing

Educational process

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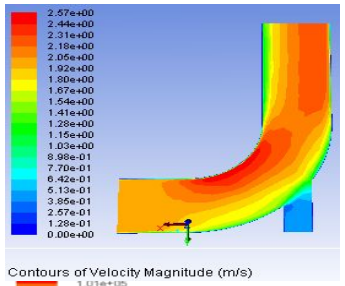
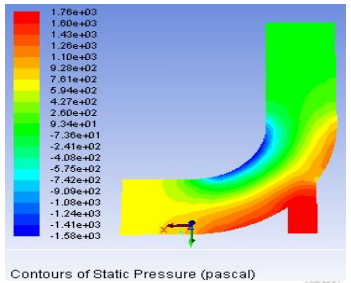
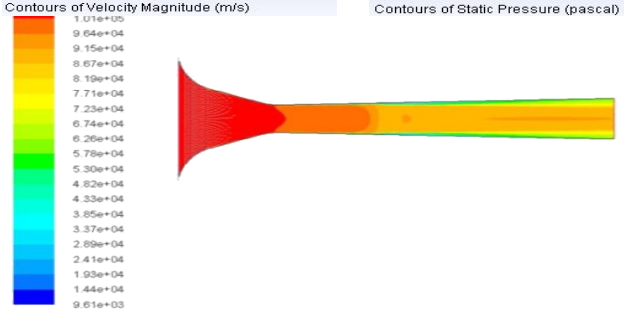
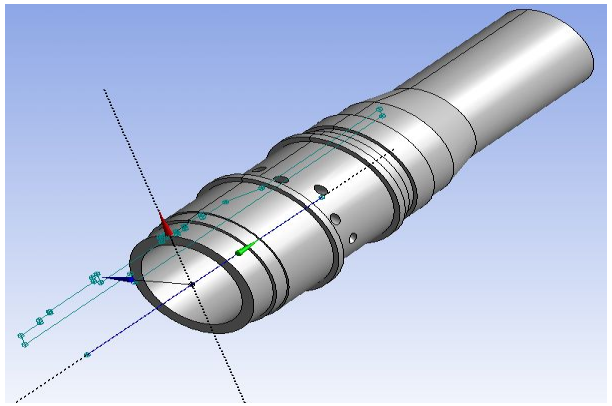
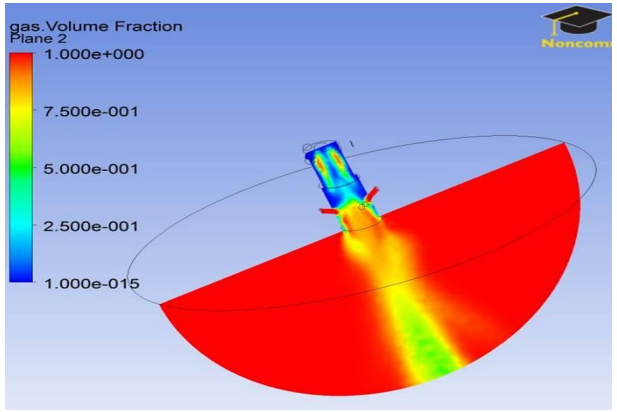
MODERN SOFWARE FOR CFD-CALCULATIONS



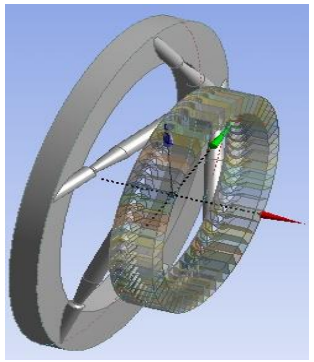


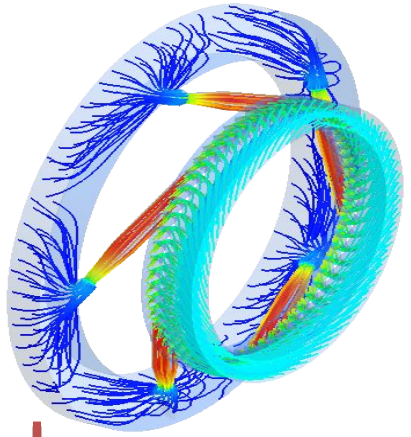




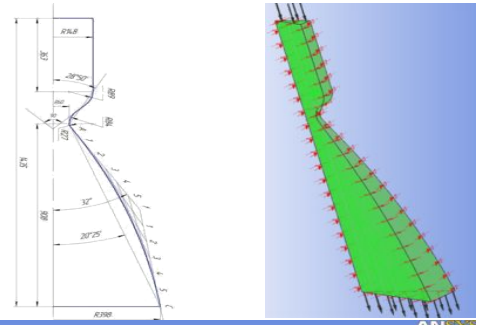


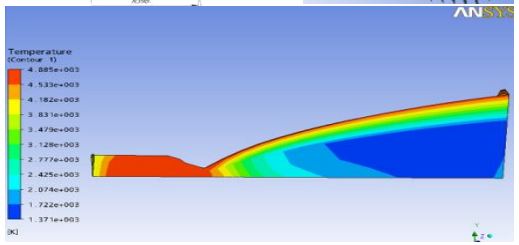
TURBO PUMP DEVICE

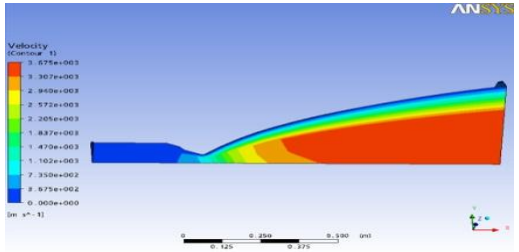




COMBUSTION CHAMBER







3 YEAR — 4 YEAR — **MASTER PROGR.**

Turbomachinery — Bachelor thesis — Master thesis

ИНСТИТУТ ДВИГАТЕЛЕЙ
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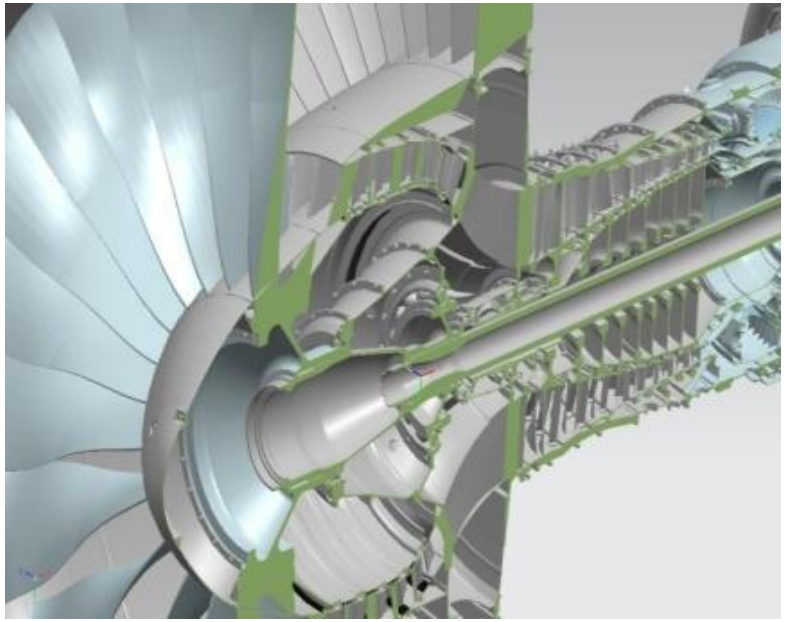
Special aspects of curriculum

Special aspects of training:



1. Continuing of professional training of bachelors:
   - Providing of thermodynamics parameters of aircraft engines
   - Construction and Design of main components and systems of engines
   - CFD-modeling

2. Scientific and fundamental training:

   - Methodology of scientific research
   - Modern problems of aircraft engine technology
   - Analytical and numerical methods of aviation and space engineering. MATLAB
   - Business foreign language

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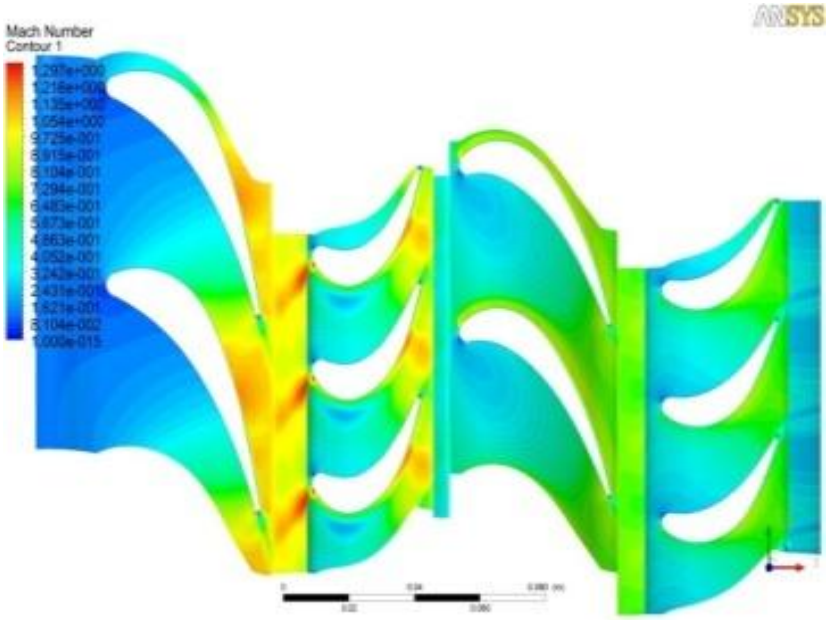
Special aspects of curriculum

3. Teaching what the specialized departments are strong in:

- Virtual product development
- CAE-modeling with engine development
- Thermal and deformation processes of engine structure
- Vibration protection system with structural damping
- Support, damping device and rotor seal designing
- Automation of strength and vibration tests with LabVIEW
- Additive technology of engine manufacturing



4. Performance of individual research tasks of Department of Aircraft Engine Construction and Design, in view of SMS «Virtual engine», and by the order of factories:

- Research work
- Individual design training
- Individual research of components and systems of engine

ИНСТИТУТ ДВИГАТЕЛЕЙ
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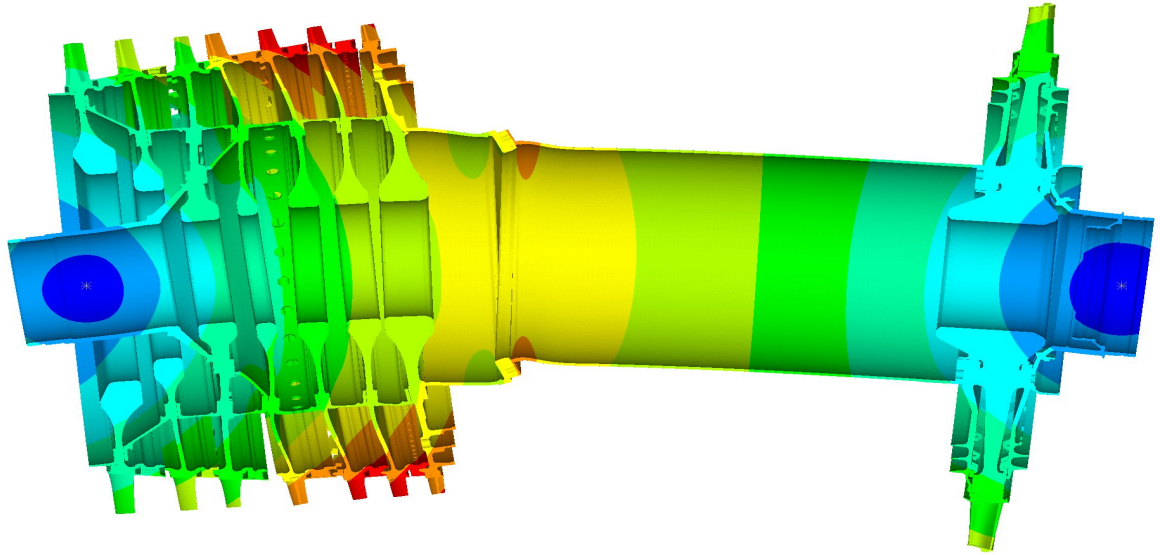
R&D and practice



Places for R&D:

- Joint laboratories
- Research laboratory «SSIL-1"
- Center of history of aircraft engines
- PAO «KUZNETSOV»

Department has:

- Joint «Research institute of advanced engine» with Stuttgart University (Germany)
- Joint research laboratory «Dynamics of aircraft engines rotors» with POLITO University (Italy)
- Two English-language summer schools for postgraduates and bachelors are held annually in cooperation with the University of Stuttgart on the problems of aircraft engine building

At the beginning of the 1st course, the research topic is agreed with the master's student and a job is also provided
It is possible to find employment at PAO «KUZNETSOV»

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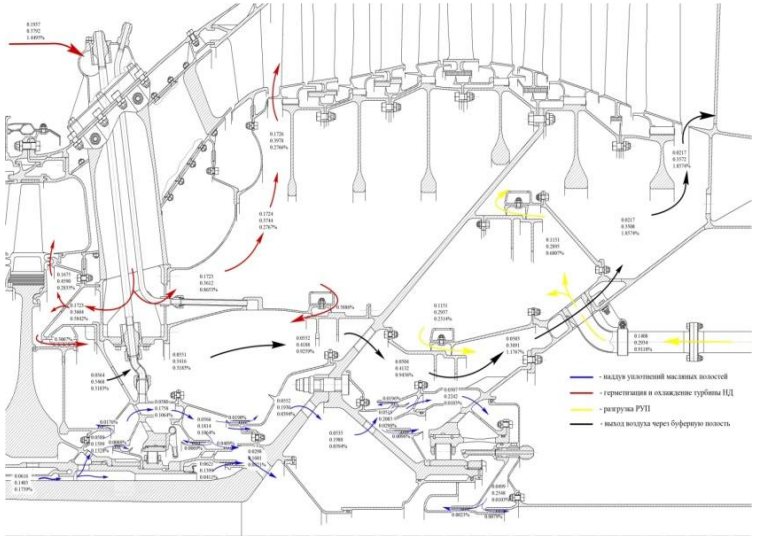
Approximate topics of R&D and graduate qualification works of master's degree students



1. Performance of works by the order of factories

2. R&D works of department

- Creation of parametric CAD models of engines and its components
- Dynamics of the "rotor-support-casing" system and its elements
- Structural strength design of engine elements
- Simulation of joint gas-dynamic, thermal, deformation, kinematic, dynamic and tribological processes occurring at engine units
- Development of a coupled model of the system of internal air flows, thermal and power loading of the aircraft engine structure
- Design of thermal and mechanical control systems for radial clearances
- Design and research of advanced seal designs (labyrinth, gas and hydrodynamic, etc …)
- Design and research of the characteristics of elastic-damping rotor supports and pipelines
- Micro GTE design development

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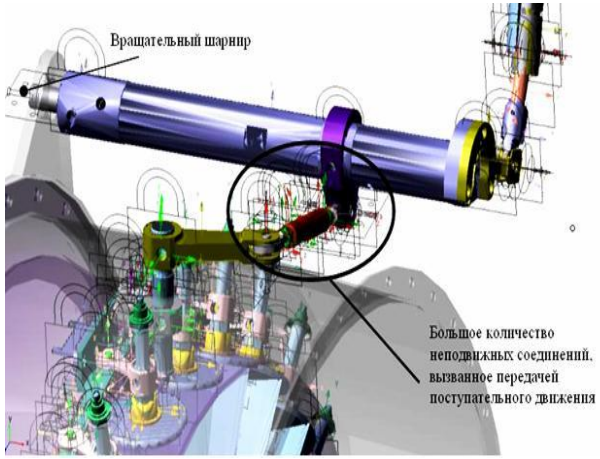
Approximate topics of R&D and graduate qualification works of master's degree students

3. Collaboration with specialist students for engines from SMS (group № 5) (for those who wish to work in design bureau) :



- Design and research of engine supports
- Design and research of tail-pipe chamber
- Design and research of propulsive nozzle
- Design and research of thrust reverse
- Design and research of elements of lubrication system
- Design and research of air system
- Design and research of regulation of radial clearances
- Design and research of air bypass and variable compressor stage guide vanes systems

4. Modernization of laboratory work in the laboratory of dynamics and strength

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Implementation schedule of R&D for master's degree students

Semester	Course name	Work
1	Scientific research work	1. Overview of design solutions 2. Publications overview 3. Preparation of a review article
2	Individual constructor preparation	1. Development of design of research component or system
	R&D	1. Familiarization with calculation methodology and its modernization 2. Preparation of article
	Workshop Practice	1. Familiarization with real constructions and experience of component or system design
3	Individual research of components and systems	1. Research of functioning of developed component or system as a part of engine
	R&D	1. Preparation of article for SCOPUS
4	Graduate qualification work	1. Work modeling of developed component or system by using models of advanced level

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Students research activities

Unsteady combustion

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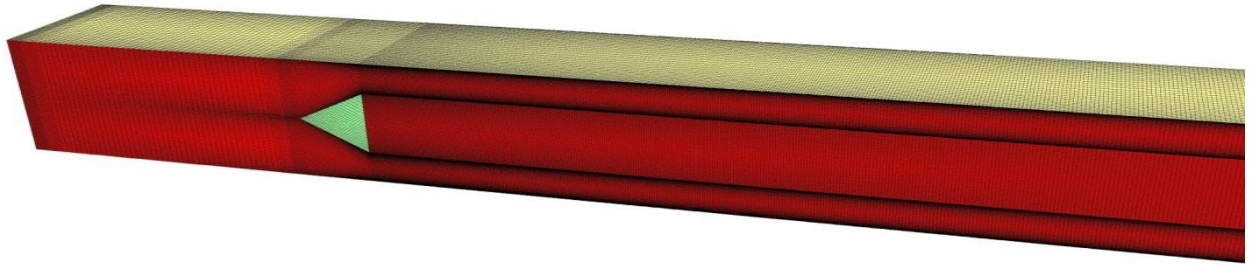
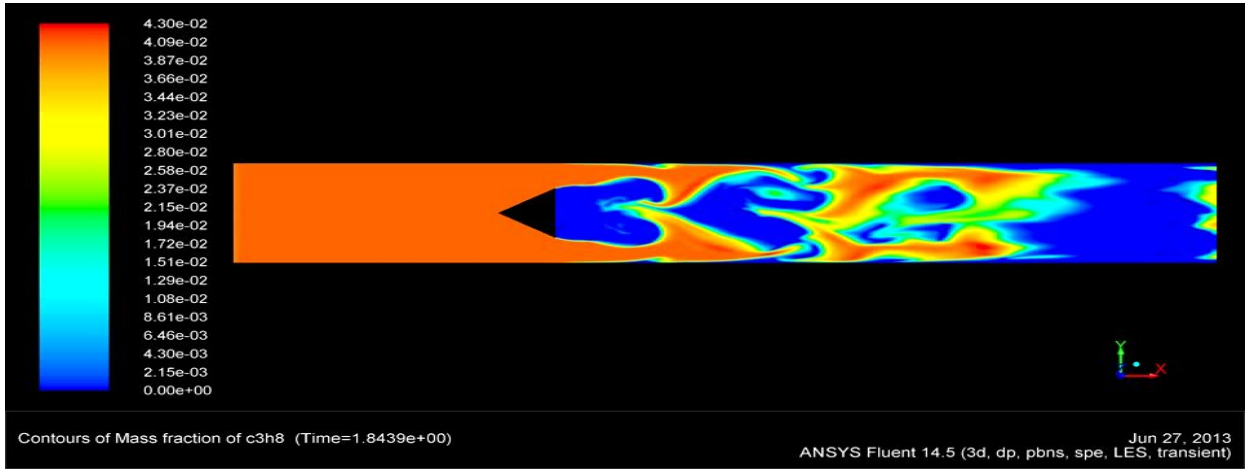
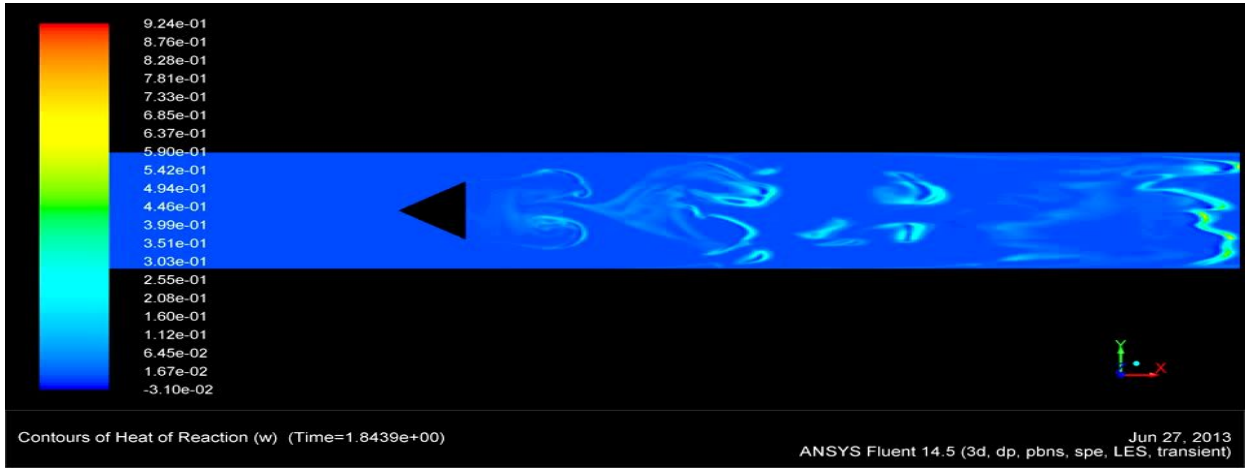
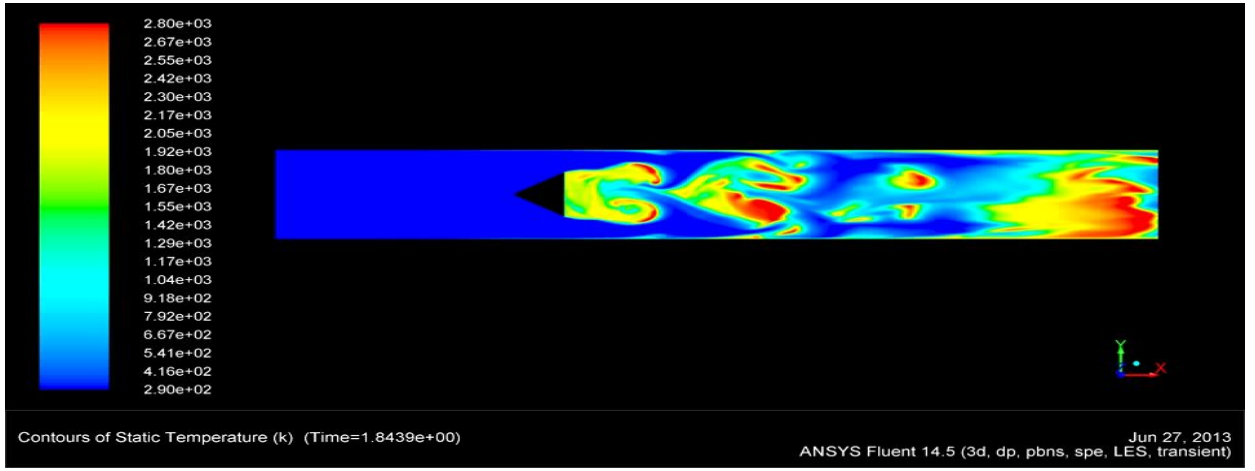
Premixed combustion
Turbulence: LES Smagorinsky-Lilly
Chemical kinetic : 21 reactions, 16 components
Chemical model: Arrhenius Rate

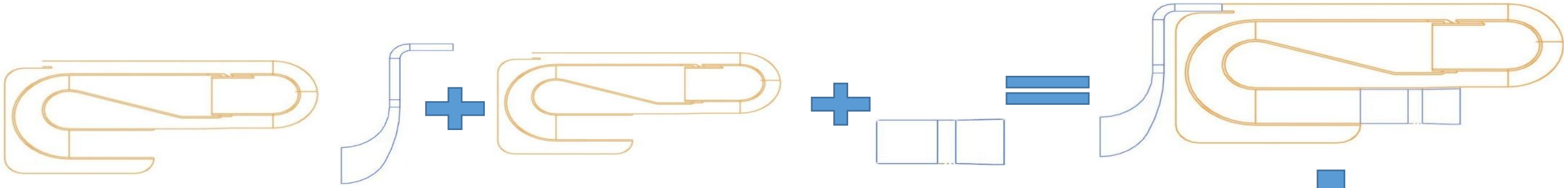


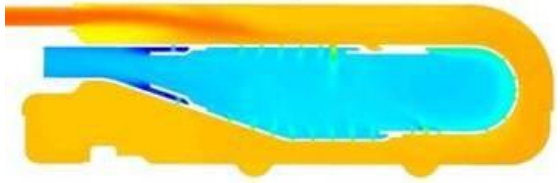




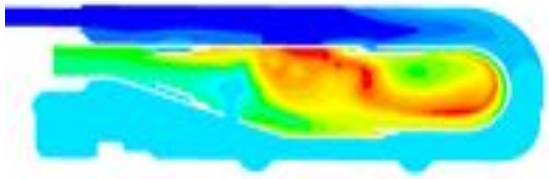


Integrated simulation of entire gas turbine engine

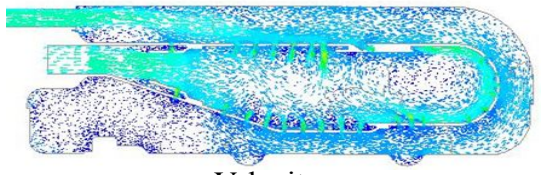




Total Pressure

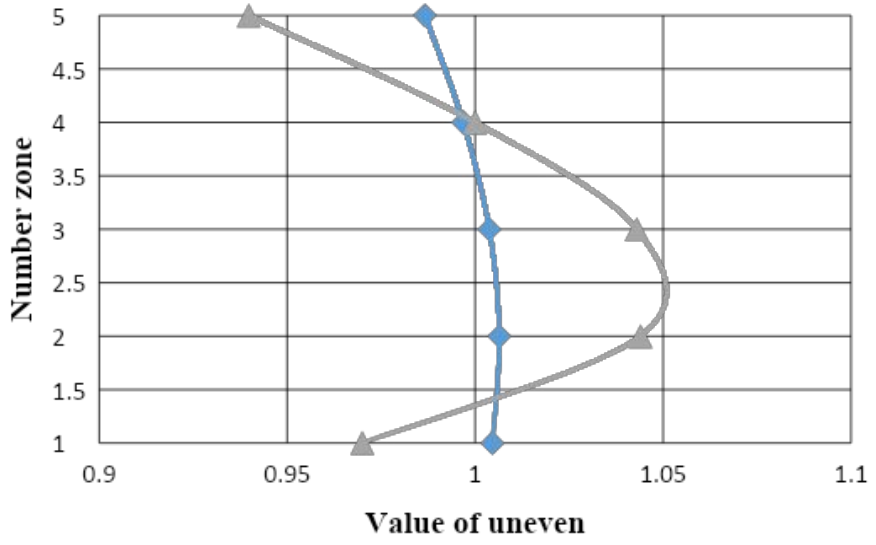


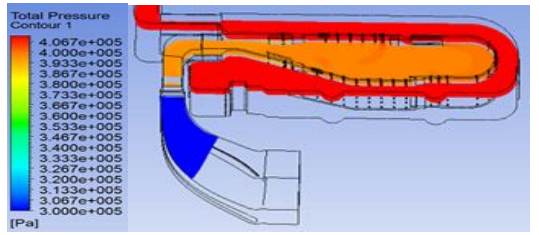
Temperature



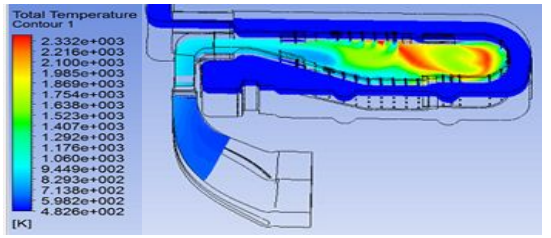
Velocity

The diagram of the radial non-uniformity at the outlet of the combustion chamber

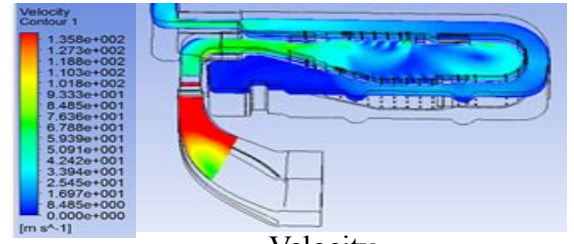




Total Pressure



Temperature



Velocity

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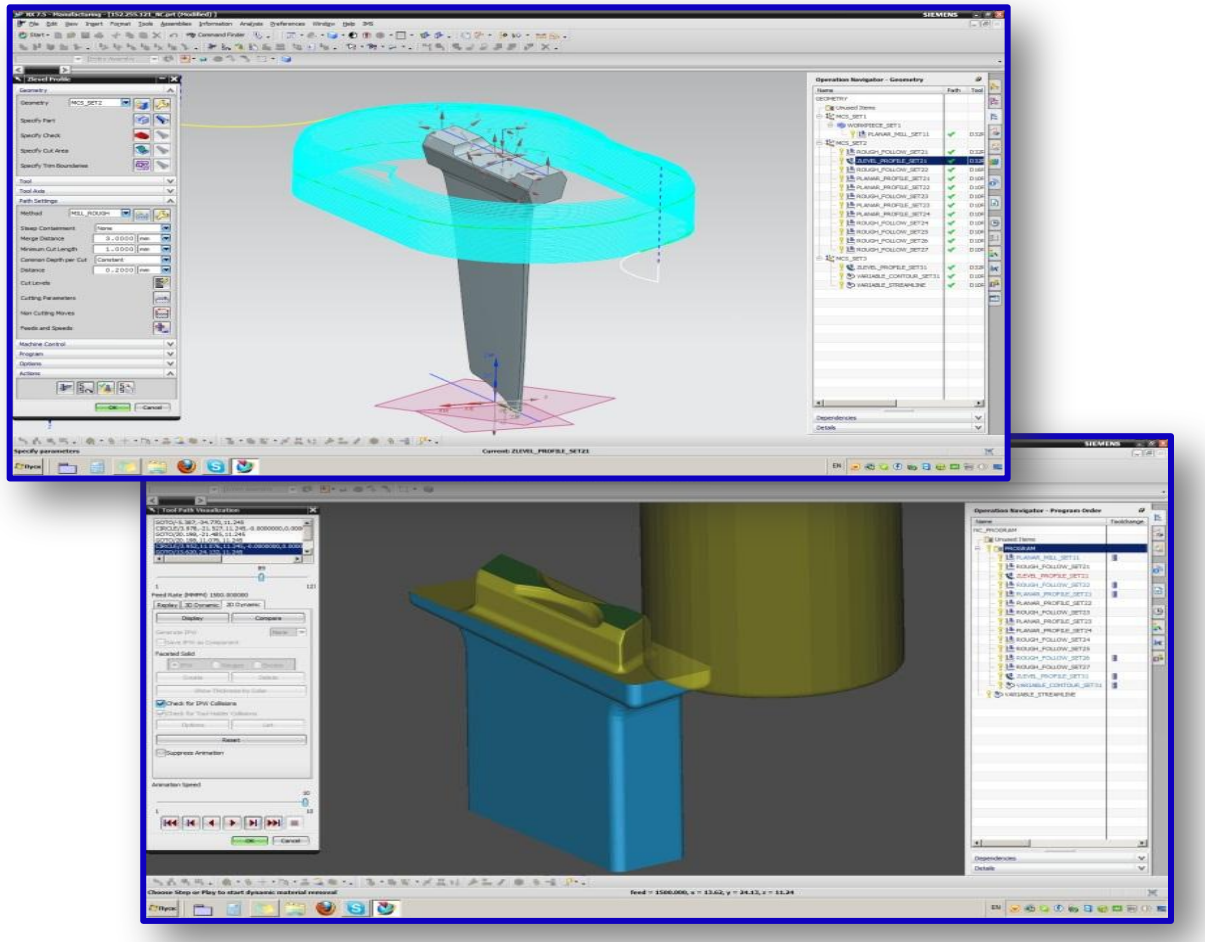
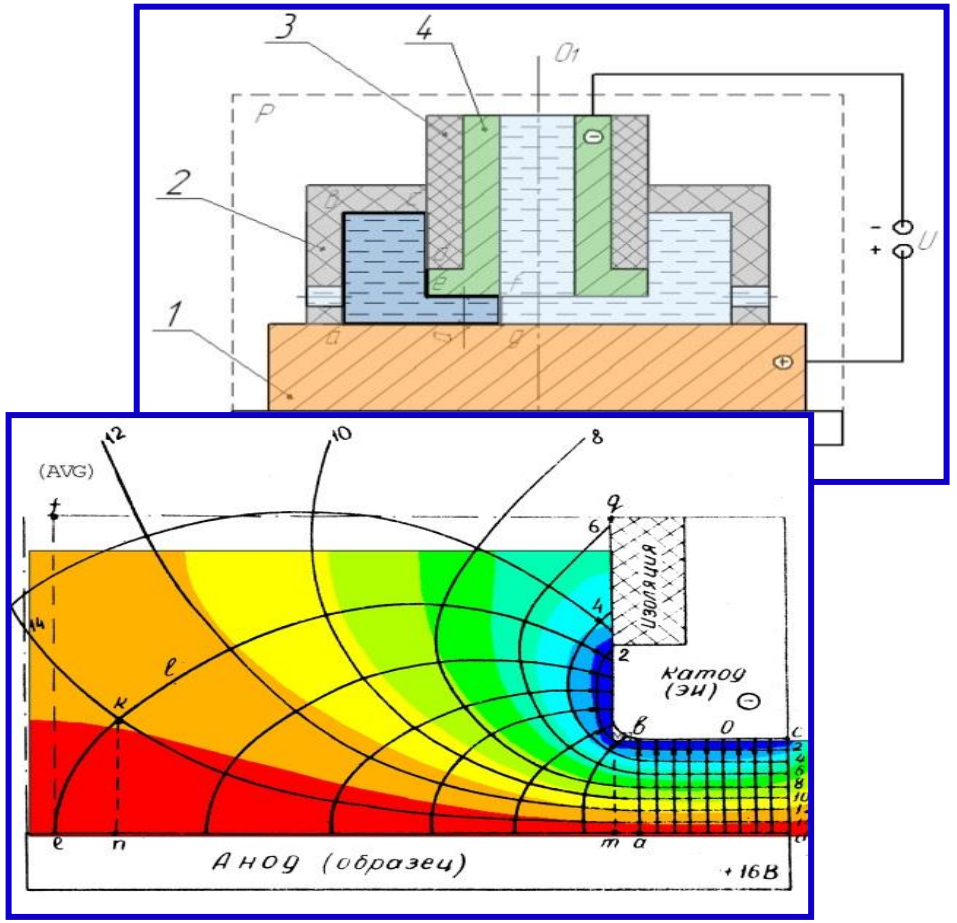
Optimization of mechanical and physico-chemical tough-to-machine material processing

Simulation of machining process



Simulation of electrochemical processing



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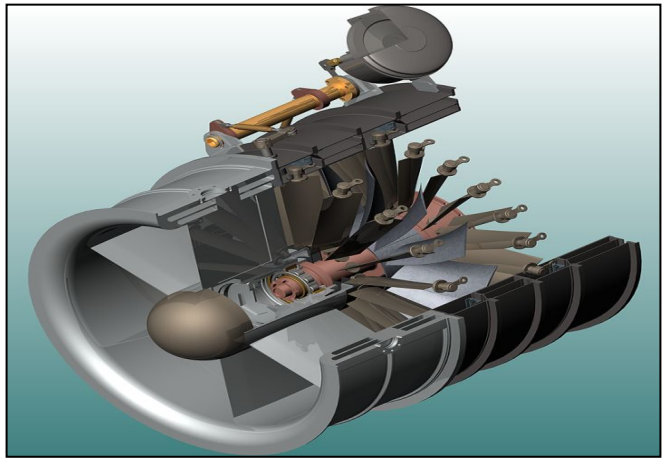
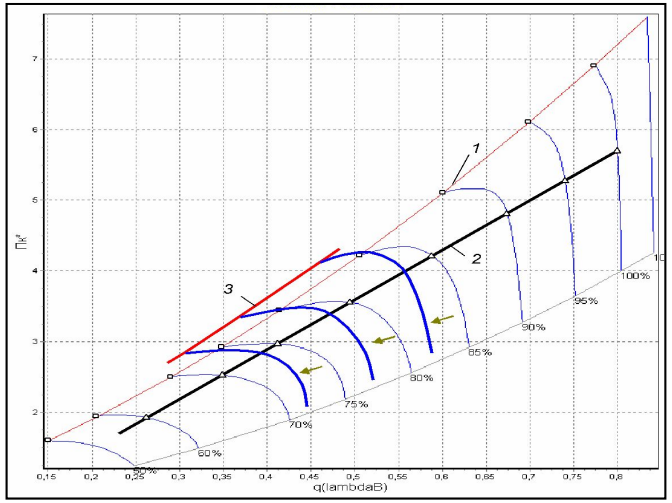
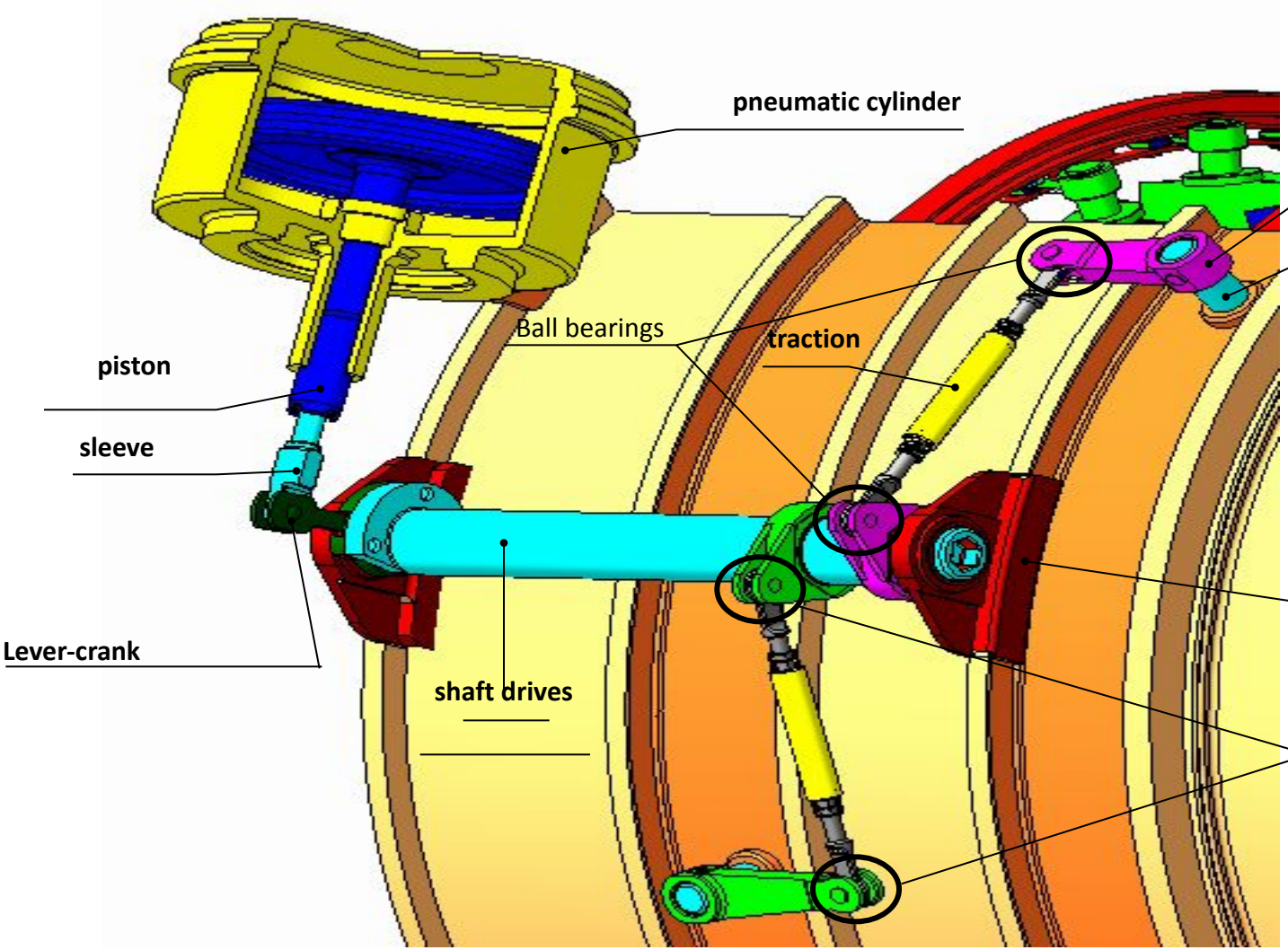
Variable guide vanes virtual testing bench







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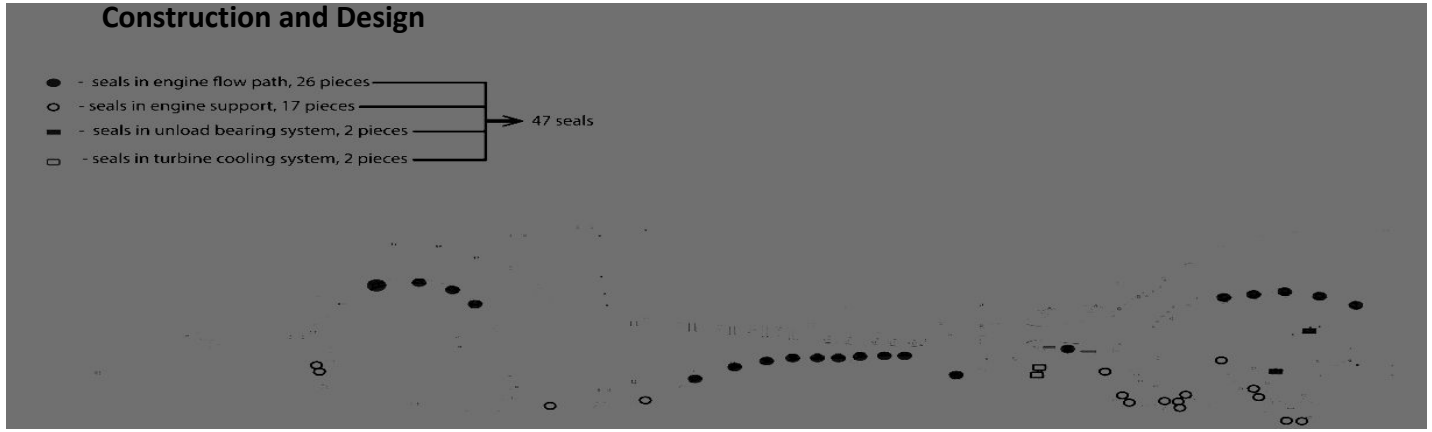
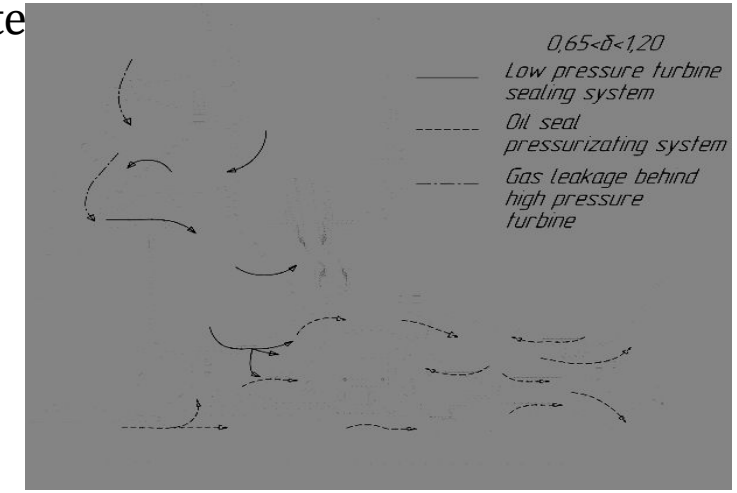
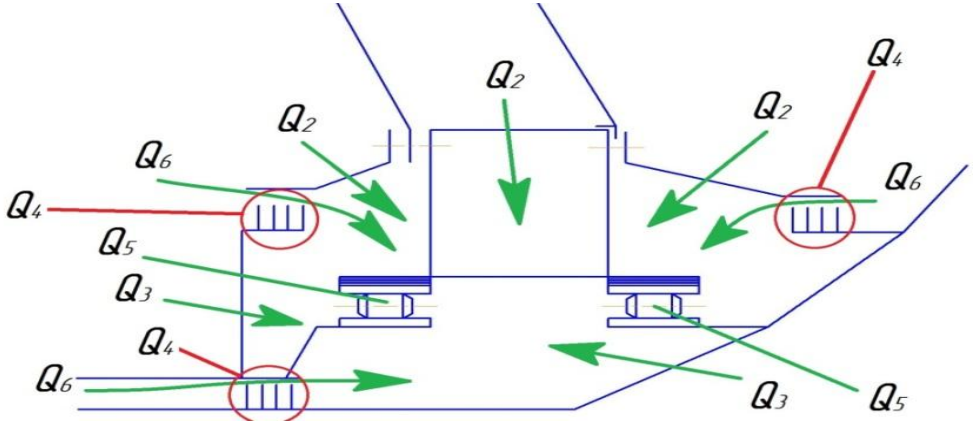
MODELLING OF SEALS

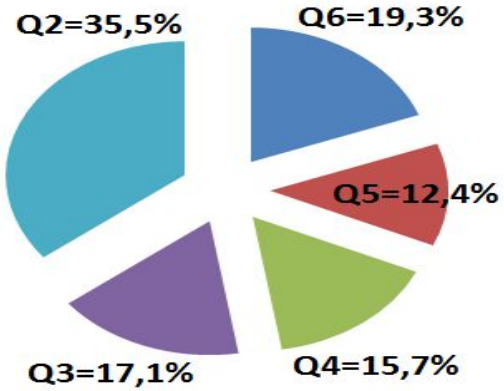
Modeling of seals in a secondary air syste

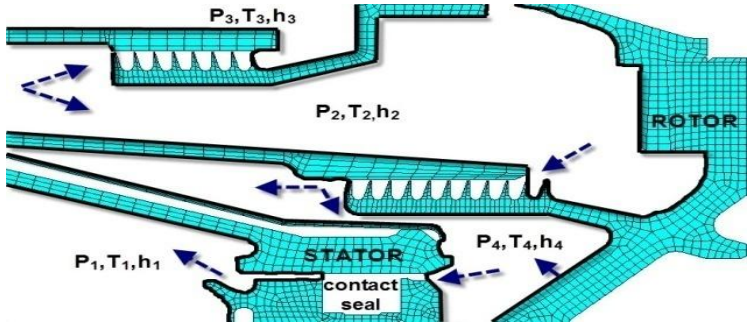




Modeling of seals in a lubrication system







Creating 3D model of the controlled jet nozzle

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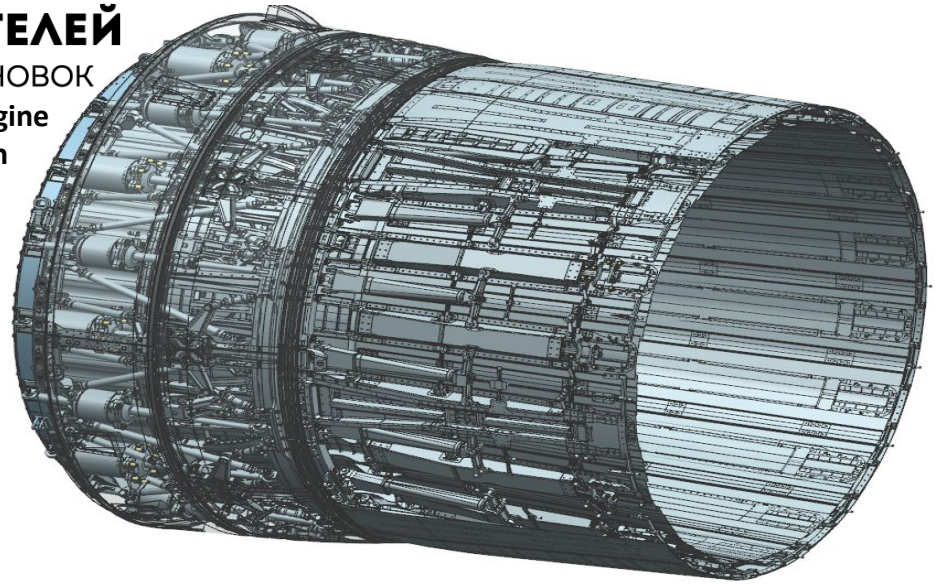
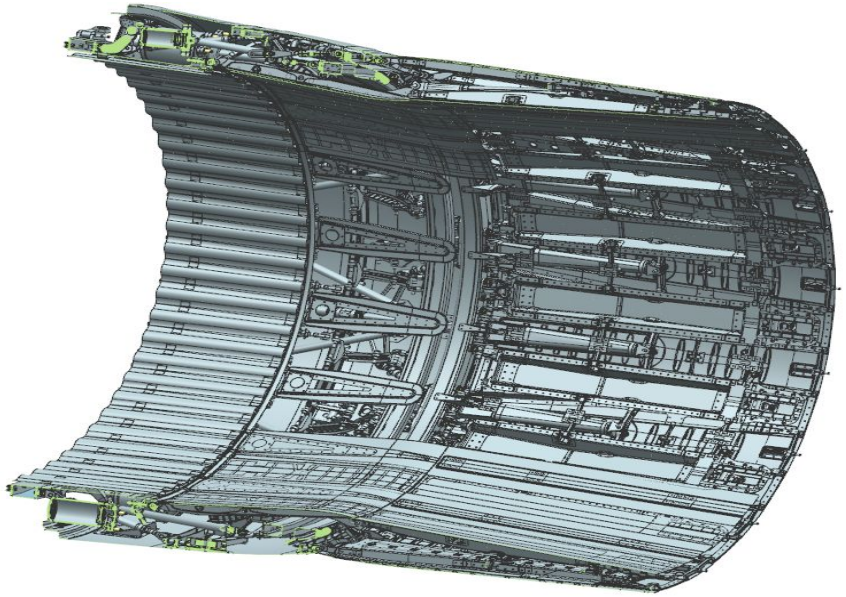
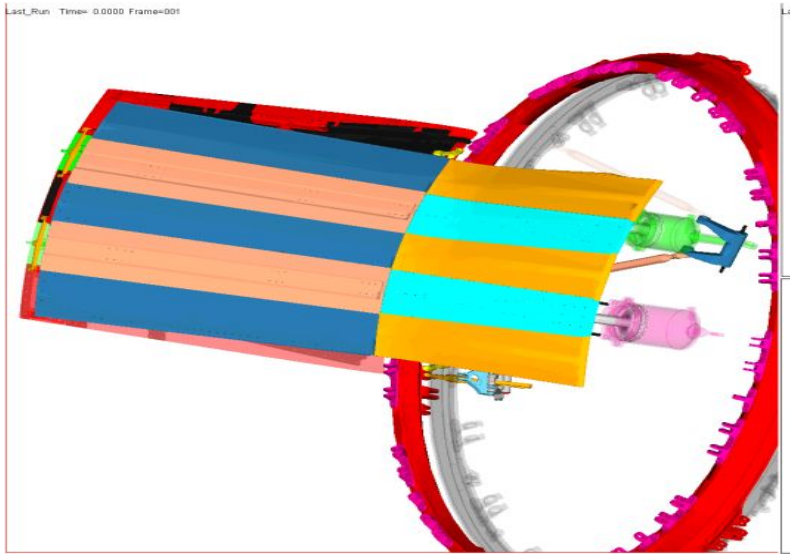
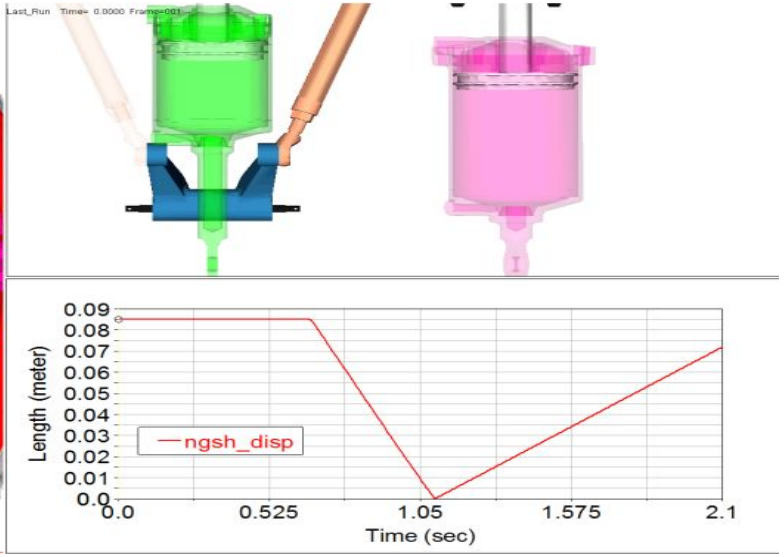




Three-dimensional models are used in to study dynamics and kinematics of a jet nozzle





Networking

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Example of framework of cooperative educational program

Master's program "Aircraft Engines and Power-Plants Designing"

Germany *Universität Stuttgart* *1 year*	+	*RUSSIA* *Samara National Research University* *1 year*

1 year in Germany + 1 year in Russia = 2 years

2 degrees

Networking

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Example of framework of cooperative educational program

Master's program "Aircraft Engines and Power-Plants Designing"

China *Nanjing University of Aeronautics and Astronautics* *1 year*	+	*RUSSIA* *Samara National Research University* *1 year*

1 year in China + 1 year in Russia = 2 years

2 degrees

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«Aircraft engine and power plant engineering» (program track 24.04.05 Aircraft engines)

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