Internship report

CADFEM

Munich, Stuttgart, Hannover

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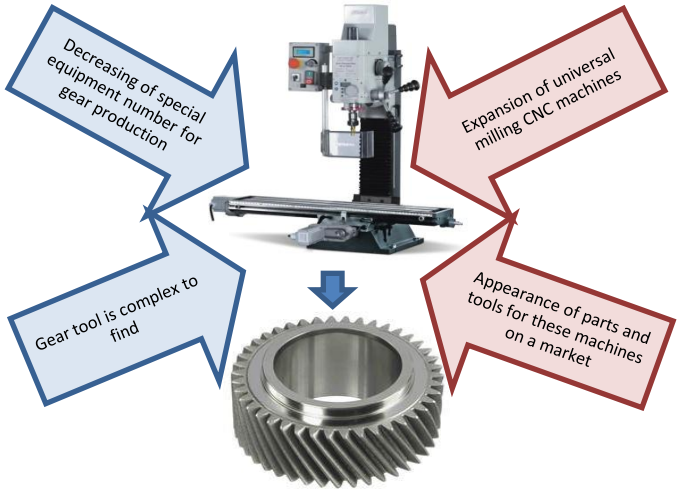
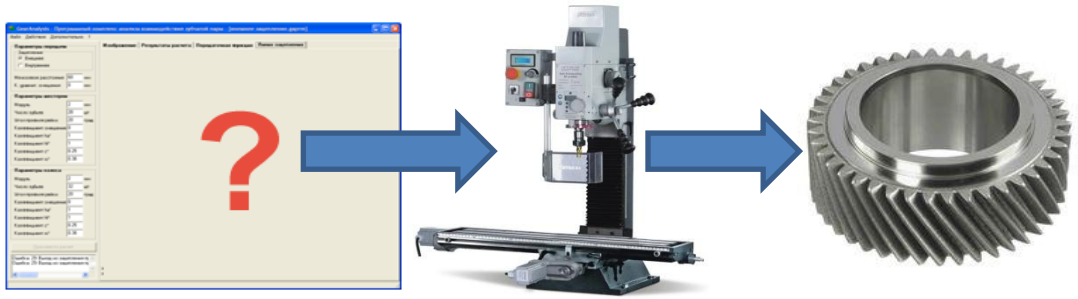
Scientific supervisor: PhD in engineering science Iptyshev A.A.

My research

- **Speciality:** Automation of design-technology engineering
- **Subject matter:** Automation of spur gear profiles preprocessing used in CAM-software





Internship objectives

- To learn the possibilities of automation in calculations by means of ANSYS system
- To train on innovative program modules development within the framework of ANSYS system

CADFEM

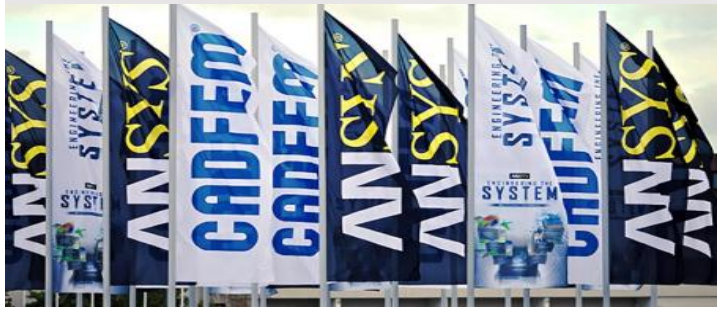
CADFEM – CAE simulations since 1985

CADFEM in D, A, CH

- 60 million euros of revenue
- 2,300 customers
- 12 locations
- 185 employees (worldwide >250)
- Family-run business

CADFEM and ANSYS partnership

- Since company's foundation
- Offering all ANSYS products
- Close technical collaboration
- CADFEM: Competence Center FEM
- ANSYS Germany: Competence Center



First week

Structural Mechanics with ANSYS Mechanical, Topology Optimization

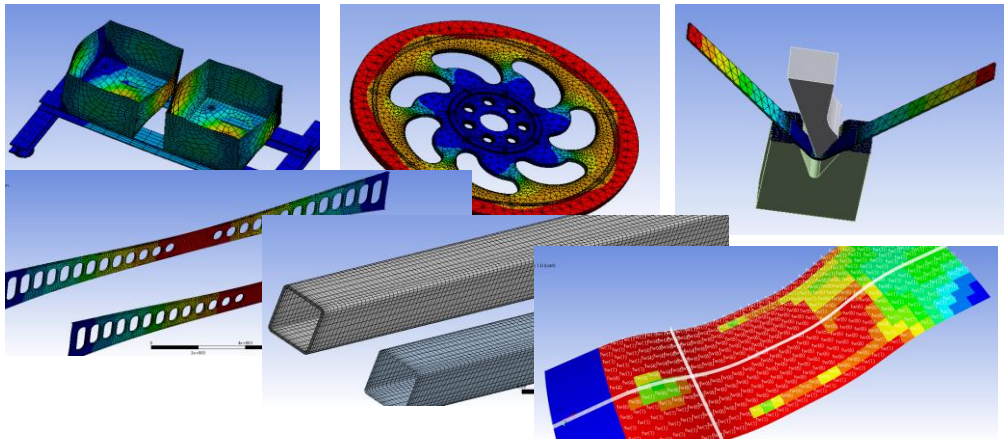
ANSYS Workbench / Software handling
- Introduction to FEM
- Demonstrator (live)
- Workbench Project page
- Material Definition
- Objects and their properties
- Coordinate Systems
- Mechanical software handling
- Named Selection Worksheet

Discretization / Theory
- Meshing (Theoretical Introduction)
- Element size of thin Structures
- Geometry Preparation
- Global Mesh Settings
- Local Mesh Settings
- Mesh based simplification
- Connecting bodies

Boundary Conditions / FE Idealization
- Introduction to Boundary Conditions
- Deformation-Boundary Conditions
- Remote Points
- Nodal Coordinate Systems
- Introduction to Nonlinear Statics
- Load-Boundary Conditions
- Inertial Loads
- Nonlinear Boundary Conditions-Contact

Evaluation of Results
- Evaluation of Results
- Adaptive Mesh Refinement
- Singularities
- Evaluation in Cylindrical Coordinates
- Construction Geometry - Path Evaluation
- Probes
- Submodeling
- Computation of large Models (HPC)

- Module 1: Material along the load paths
  - Motivation
  - Concept of the topology optimization
  - ACT Extension
  - 2D michell-structure (Hands-on)
- Module 2: Without restrictions it will not work
  - Design constraints
  - Maunfacturing constraints
  - Generic engine mount (Hands-on)
- Module 3: Different ways to get the optimal design
  - Objective functions
  - Comparison of different objectives (Hands-on)
  - Single Compliance vs. Multiple Compliance (Hands-on)
- Module 4: Redesigning
  - ANSYS Topology Optimization → ANSYS SpaceClaim (Hands-on)



Second week

Customization with ACT, High Performance Computing (HPC)

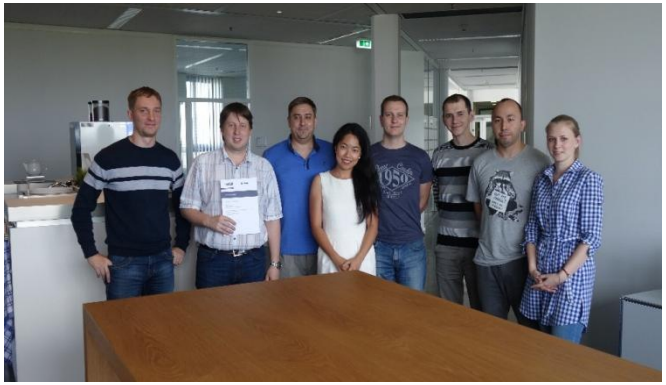
First day
- Introduction ACT
- (Iron)Python
- XML format
- Toolbar
- Journaling (project schematic)

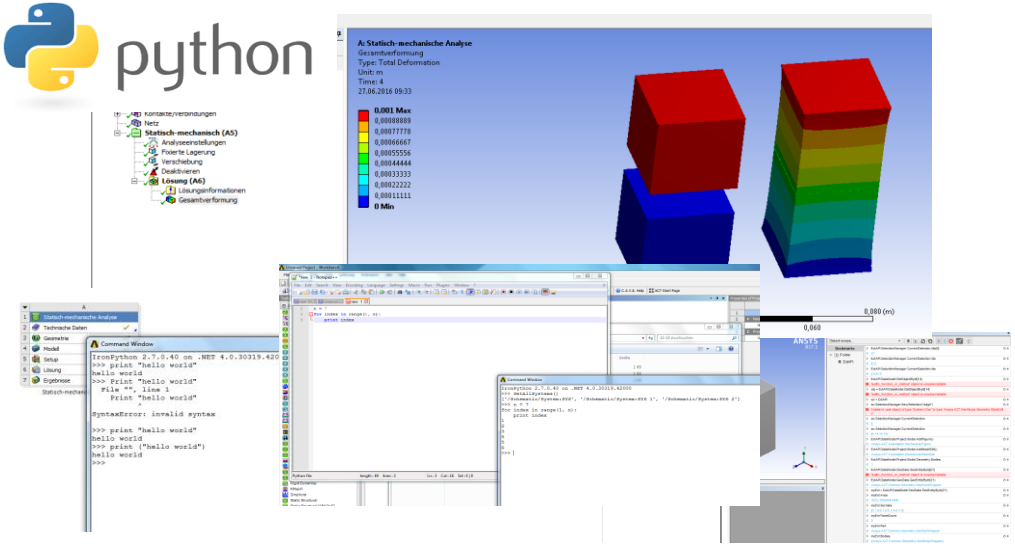
Second day
- ACT console
- Change and insert standard features
- Pre-processing feature (reuse APDL)
- Post-processing feature
- Graphic
- Create report

Third day
- Excercise: fix displacement
- Compiling an extension
- Wizard
- Libraries
- Optional topics
  - DesignModeler
  - Insert meshfeature
  - Rename by class
  - Debugging_with Visual Studio

Day 1 – Modelling techniques
1. Purpose
2. Submodelling and External Data
3. Substructuring, CMS

Day 2 – High Performance Computing
1. Solvers (structural, thermal, Eigen-,)
2. Components and aspects of HPC
3. „Do …“ and „Don‘t …, if you can do it in another way“

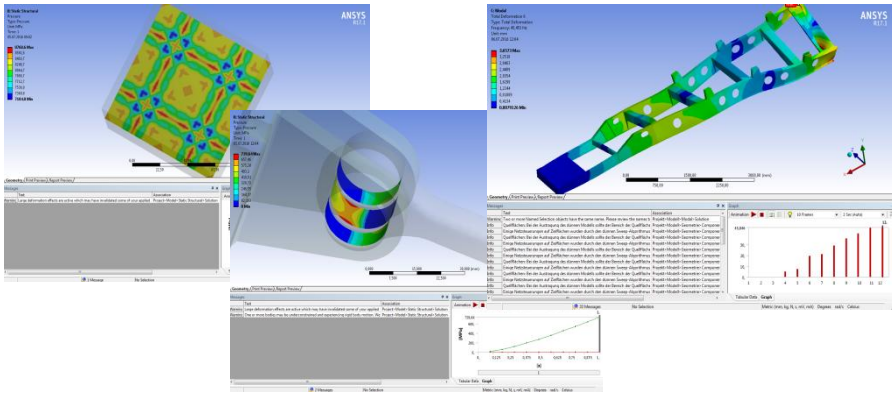


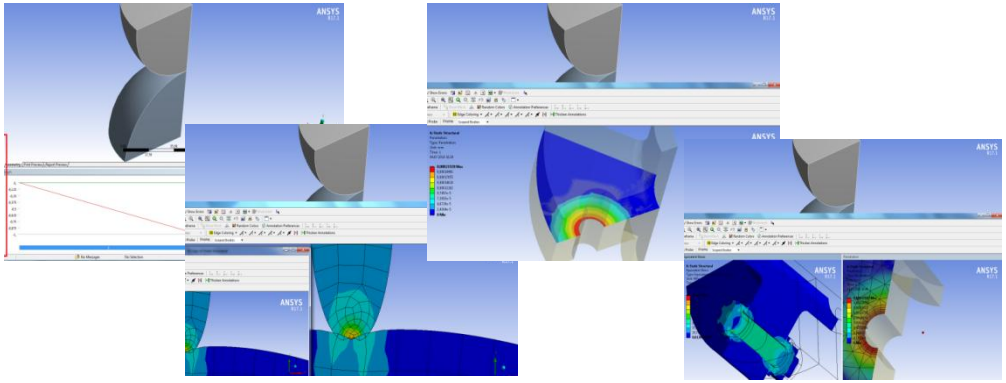


Third week

Contact Modeling with ANSYS Mechanical

- Day 1
  - 2.) Illustrative Introduction
  - 3.) Connection Groups
  - 4.) Contacts between Surface Bodies
  - 5.) Analysis Settings
  - 6.) Input and Output Files
  - 7.) Contact vs. Target
  - 8.) Force Control vs. Displacement Control
  - 9.) Evaluation of Results
  - 11.) Trim Contact
- Day 2
  - 10.) Contact Elements
  - 12.) Types of Contact
  - 13.) Detection Method
  - 14.) Pinball-Region
  - 15.) Contact Algorithm
  - 16.) Contact Stiffness
  - 17.) Penetrations
- Day 3
  - 18.) Bending Example
  - 19.) Rigid Body Motions
  - 20.) Bonded Contact
  - 21.) Contact Treatment
  - 22.) Convergence Treatment





Conclusions

- Pros
  - Calculation of products durability
  - Launch of automatic parametrical simulations
  - Automation of ANSYS simulations by means of ACT
- Cons
  - Dynamic simulations classes were not available