



Educational and Industrial Multiphysics Modeling in the Czech Republic

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About Company

HUMUSOFT s.r.o.

- Founded in 1990, privately held
- Located in Prague, Czech Republic
- Representative of COMSOL since 1999 for several countries of Middle and Eastern Europe
- At present time there are about 200 sites of COMSOL Multiphysics in our territory
- COMSOL Multiphysics is mostly used in academic area, but there is a growing proportion of commercial users here.





Vehicle Bodywork Design

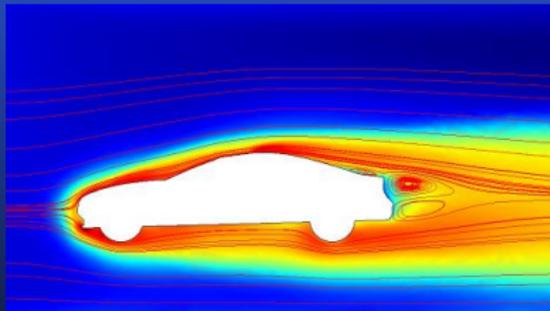
- the model of the car was manufactured on a 3D printer
- it was tested in a wind tunnel at Aeronautical Research and Test Institute in Prague - Letnany.
- the air flow around the car (2D model) was modeled using COMSOL Multiphysics



Program CATIA



Production of a part of the model from SURFCAM application



- used k- ϵ turbulent model for air speed 20m/sec



All slices of the car



All slices put together before finish

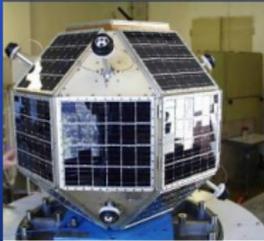
<http://www.designtech.cz>



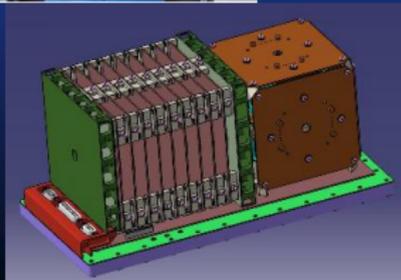
Highly Sensitive Microaccelerometer

COMSOL Multiphysics solving part of satellite

- user - Aeronautical Research and Test Institute
- major centre for aeronautic research, development and testing in the Czech Republic
- cooperation with Czech aviation industry, ESA (European Space Agency), NATO, ...



<http://www.vzlu.cz>



- plan to use **COMSOL Multiphysics** for solving the space highly sensitive microaccelerometer model for satellites
- geometry is developed in external CAD package CATIA 5
- thermal transient analysis and calculation of temperature field and temperature gradients will be solved



Siemens VDO Automotive

- **Design of level and temperature sensors for cars and trucks**
 - using COMSOL Multiphysics for simulation of sensors placed in engine blocks
 - Heat Transfer Module used
 - including of surrounding environment in the model (oil) at temperatures about 100 °C, quick changes of temperatures in the range from -40°C to 150°C and more
 - analysis of sensor's components
- customers of Siemens VDO Automotive



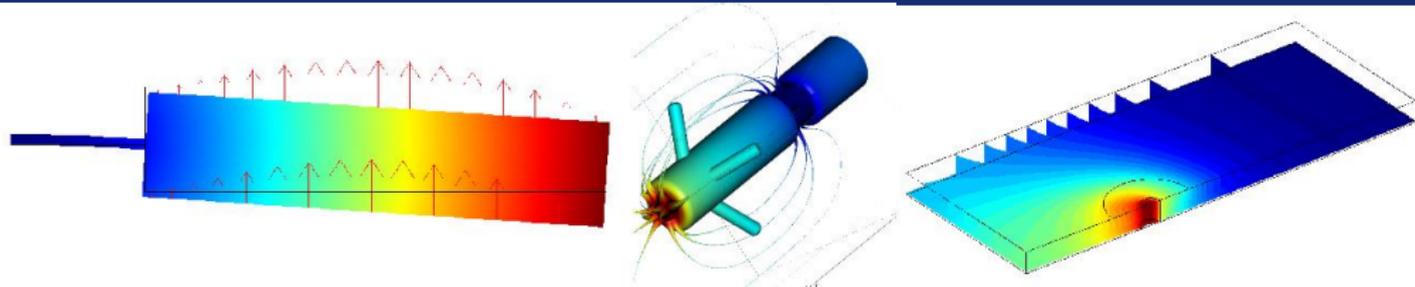


University Education

- J.E.Purkyně University in Ústí nad Labem

<http://www.sci.ujep.cz>

- Department of Physics, Head of department is **Dr. Zdeněk Moravec**
- they are using COMSOL Multiphysics for education
- more illustrative environment for students, not necessary to know programming language for solving PDE problems
- the solution is not necessary teoretically analyse but immediately to solve problem from practice
- the aim is to introduce COMSOL Multiphysics as another way of solving FEM problems
- they plan to develop semestral exercises





University Education

• Education on Technical University in Brno using COMSOL Multiphysics

- students solve examples from waveguide simulation and planar conduction area, on line exercise assignment on web pages

faculty of electrical engineering and communication ut brno

795x747

The Faculty of Electrical Engineering and Communication provides education in Electronics and Communication, Cybernetics, Control and Measurement Techniques, Microelectronics and Technology, Power Electrical and Electronic Engineering and Telecommunications.

There are 12 departments in the Faculty, with about 100 teachers, 300 PhD students and more than 4,000 students in BSc and MSc study programmes. The quality of teaching is guaranteed by accreditation procedures, now at the national level by the Czech Ministry of Education, another by the European Association of Technological Universities (EUTU).

There is a growing participation of students and staff in international and national European research projects funded by the EU (Comenius, Ecostic, European and others). The Faculty maintains contacts with many foreign universities and research institutions.

<http://www.feec.vutbr.cz>

2. POČÍTAČOVÉ CVIČENÍ

Cílem cvičení je seznámit se s numerickým modelováním vysoko-frekvenčních a mikrovláknových vedení. Šíření vlny vedením bude nejlépe simulováno jedním z programů FEMLAB, editorů programů vlnové funkce, vlnovodu, který si vytvoříme v programu MATLAB.

Obdélníkový vlnovod Vlnovod II Ztáčkový mikrovlnek

– horn antennas

3. POČÍTAČOVÉ CVIČENÍ

Cílem cvičení je seznámit se s numerickým modelováním aperturních a trnových antén. Parametry antén budeme analyzovat pomocí programu FEMLAB. Výsledkem analýzy bude směrová charakteristika antény.

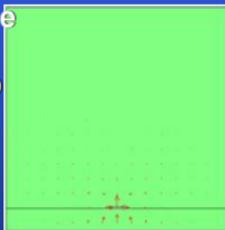
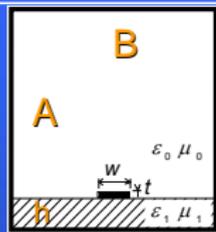
Obdélníkový trnovitý Kruhový trnovitý



University Education

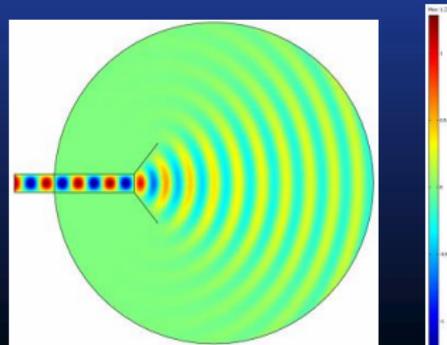
• Example 1: Planar transmission lines

- Analysis of the shielded microstrip transmission line at frequency $f = 10$ GHz. Dimensions of the shielding waveguide are $A = B = 12.7$ mm, the height of the substrate is $h = 1.27$ mm and its permittivity $\epsilon_r = 4.2$. The width of the microstrip is $w = 1.27$ mm and its thickness $t = 0.08$ mm
- The obtained field distribution is typical for the dominant quasi-TEM wave – the longitudinal component of the electric field intensity is negligible (a green background), and transversal components seem to radiate from the microstrip (red arrows). Phase propagation constant of the dominant mode at the given frequency is $371 \text{ rad}\cdot\text{m}^{-1}$.



• Example 2: Horn antennas

- Electromagnetic field distribution inside and outside the analyzed hog-horn. Electric field intensity component perpendicular to the screen is depicted.





**Thank you for your
attention**