Kan man böja en bit komposit med matematik som redskap?

Fraunhofer

CHALMERS
Research Centre
Industrial Mathematics

MY-dagen 2013-10-28
Cornelia Jareteg

Min bakgrund

- Matematikprogrammet GU, 2007-2010
- Masterprogram GU inriktning tillämpad matte, 2010-2012
- Kontrakterad student FCC, 2010-2011
- Exjobb FCC, våren 2012
- AEM student FCC/Chalmers (industridoktorand), sedan sep 2012

FCC - Fraunhofer-Chalmers Centre for Industrial Mathematics

Avdelningar

Geometry
and Motion Planning

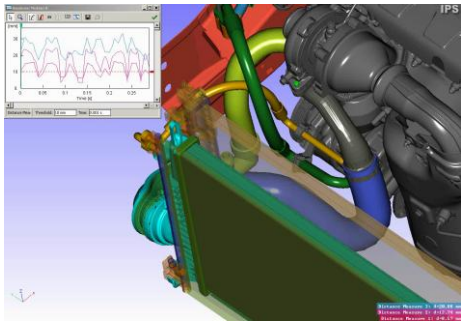
Computational
Engineering and Design

Systems
and Data Analysis

Fraunhofer ITWM
CHALMERS
Research Centre
Industrial Mathematics

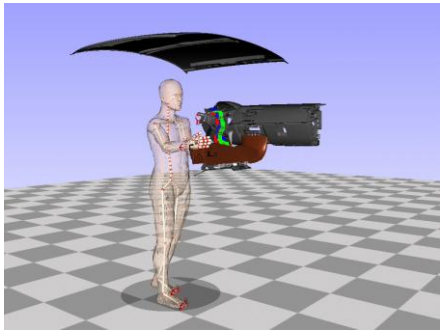
Geometry and Motion Planning

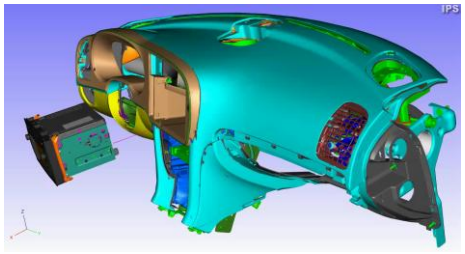
Math based algorithms and software for efficient product and production development, including automatic verification of assembly feasibility, design of flexible components, motion planning and optimization of multi-robot stations, and simulation of key surface treatment processes

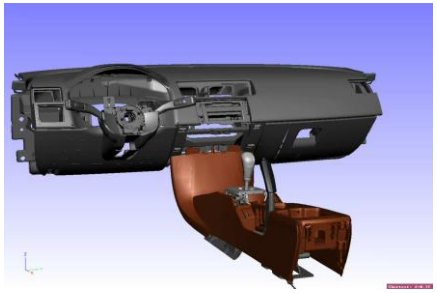


Competences:

- Automatic Path Planning
- Optimization of Multi-Robot Stations
- Real Time Simulation of Flexible Parts
- Intelligent Moving Manikin for Assembly
- Visualization and Computer Graphics
- Statistical Methods for Geometry Assurance



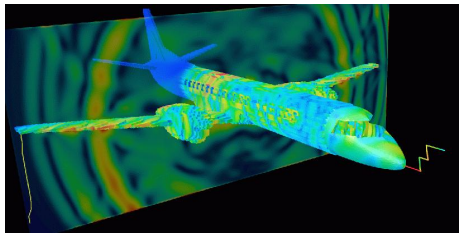




Fraunhofer ITWM
CHALMERS
Research Centre
Industrial Mathematics

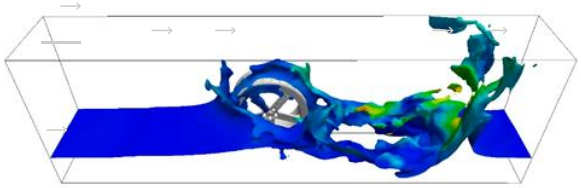
Computational Engineering and Design

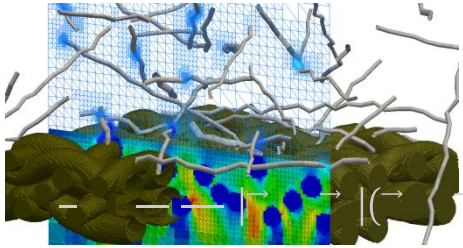
Multi-physics modeling, simulation and optimization of products and processes emphasizing mathematical modeling, numerical methods, algorithmic design and innovative software

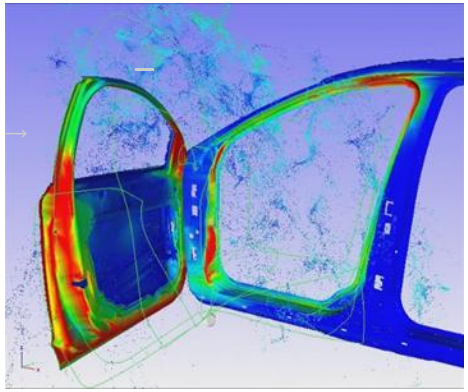


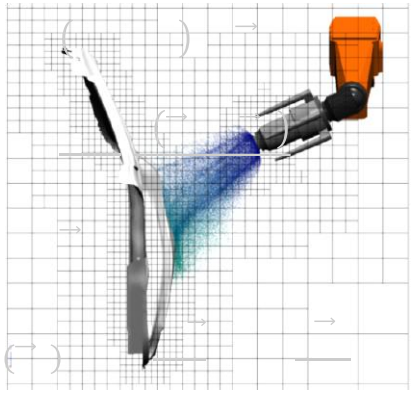
Competences:

- Computational electromagnetics
- Complex flows
- Multi-physics simulations
  - Fluid-EM coupling
  - Fluid-heat transfer coupling
  - Fluid-structure interaction
- High performance computing
- Simulation-based optimization
- Computational aeroacoustics

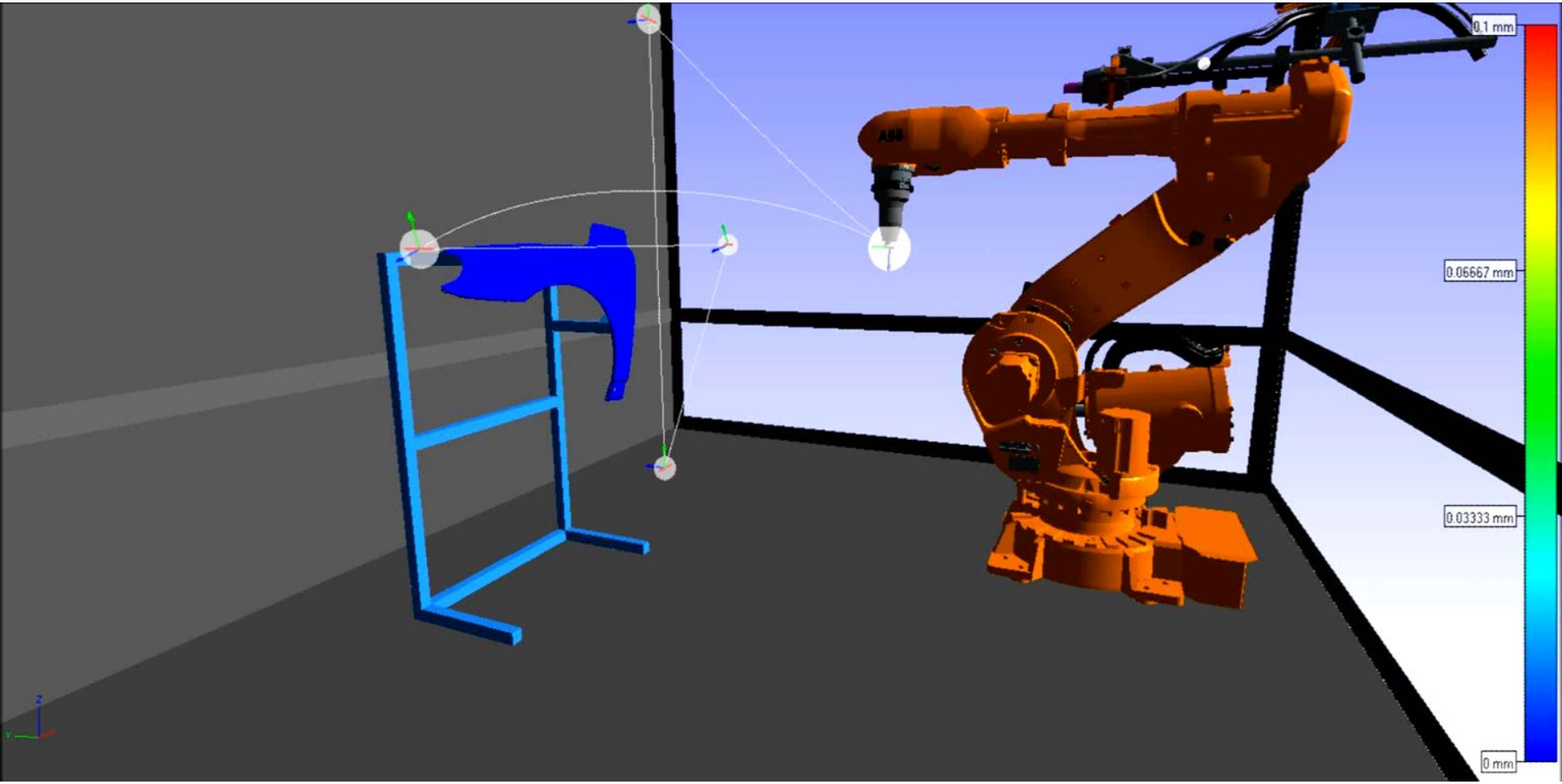




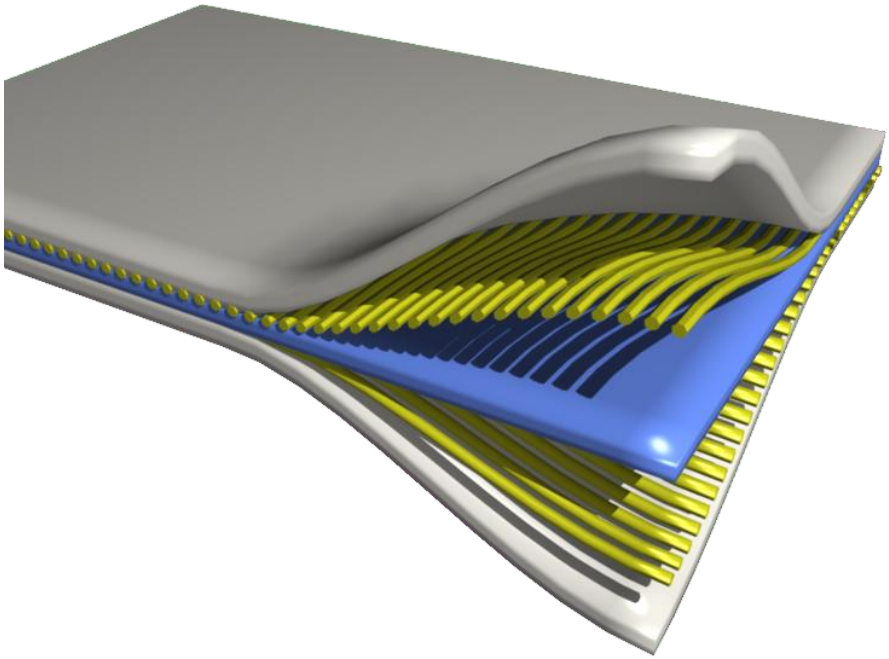




Fraunhofer ITWM
CHALMERS
Research Centre
Industrial Mathematics



Fraunhofer ITWM
CHALMERS Research Centre Industrial Mathematics
SAAB
VOLVO
SCANIA
FORDONS KOMPONENT GRUPPEN
swerea IVF
GM



KOMPOSITER

Fraunhofer ITWM

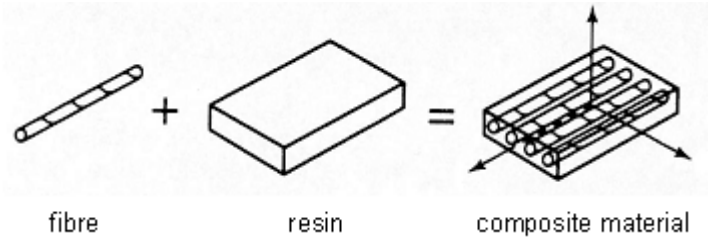
CHALMERS
Research Centre
Industrial Mathematics

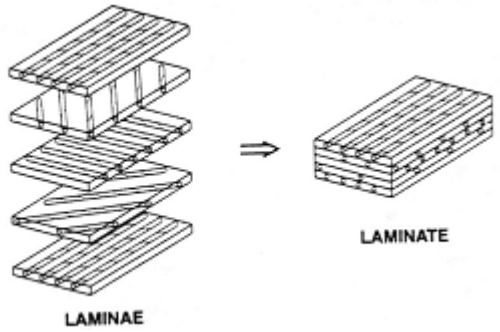
Vad är kompositer?

- Sammansatta material, t.ex.
  - Betong (cement+sten)
  - Plywood (trä+trä i lager)
  - Papiere-mache (papper+lim)
  - Fiberförstärkt plast …

Fiberförstärkt plast (“Svart stål”)

- Plastmaterial
  - Epoxy
- Fibrer
  - Kolfiber
  - Glasfiber
  - Aramidfiber (Kevlar)





DEFORMATION

Fraunhofer CHALMERS
Research Centre
Industrial Mathematics

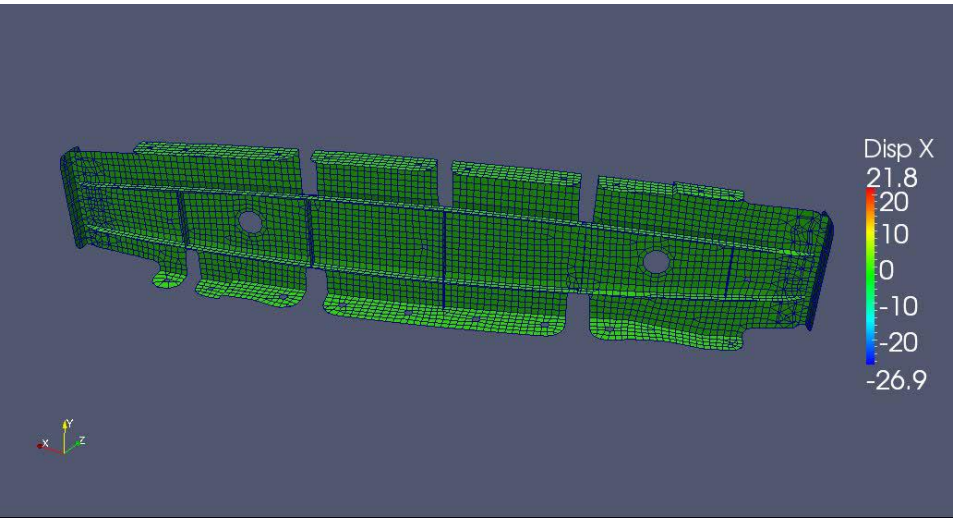
Kan man böja en bit komposit med matematik som redskap?

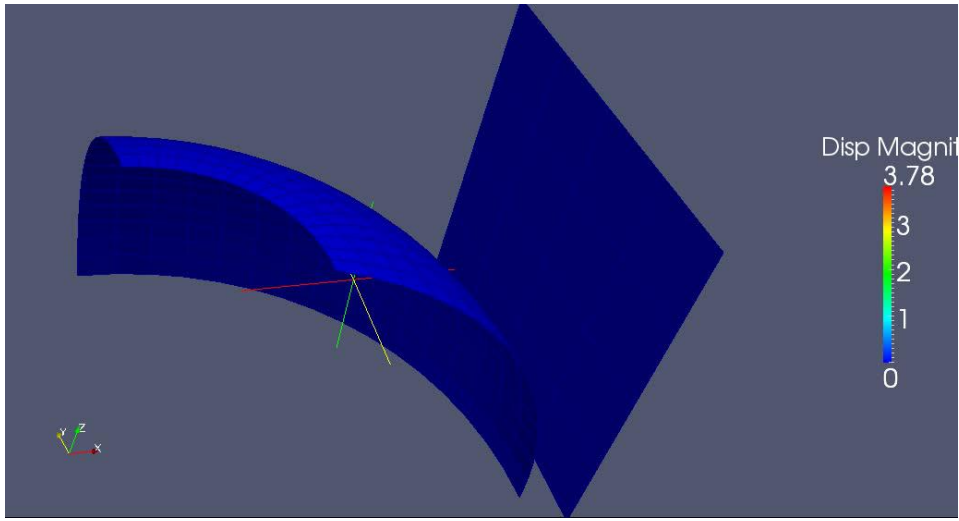
- Ja det kan man!

- Varför vill man göra det?
  - Dyrt med fysiska tester

- Vilken typ av matematik behöver man då?
  - PDE, Partiella differentialekvationer
  - FEM, Finita Elementmetoden

Simulering deformation





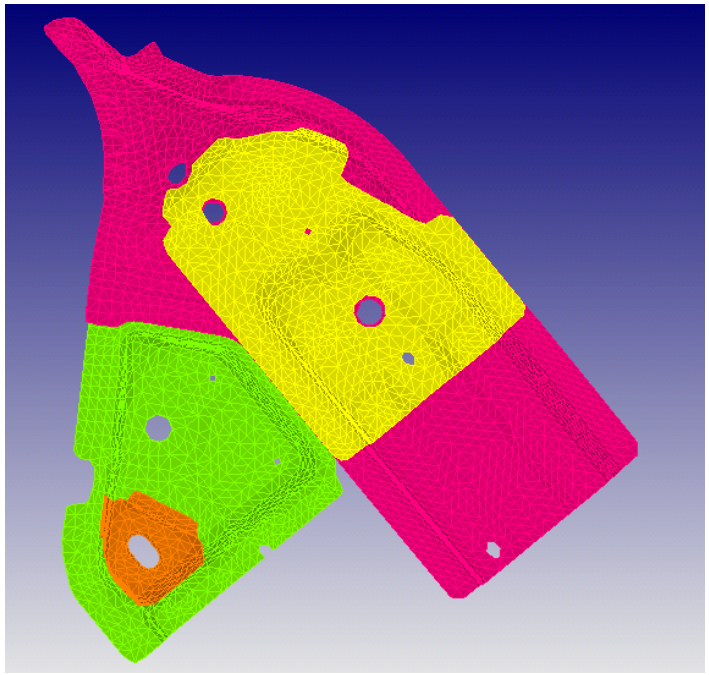
Fraunhofer ITWM
CHALMERS
Research Centre
Industrial Mathematics

TILLÄMPNING DEFORMATION

Fraunhofer CHALMERS
Research Centre
Industrial Mathematics

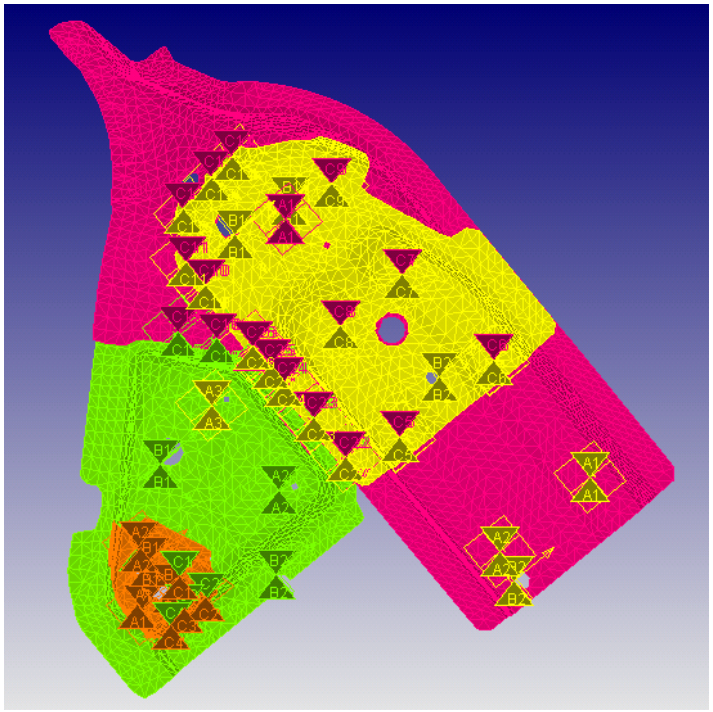
Geometrisäkring / Variationssimulering

- Nominell bit
- Variationer i varje bit
- Resulterande variation i assembly
- Garantera slutprodukt inom toleranskraven

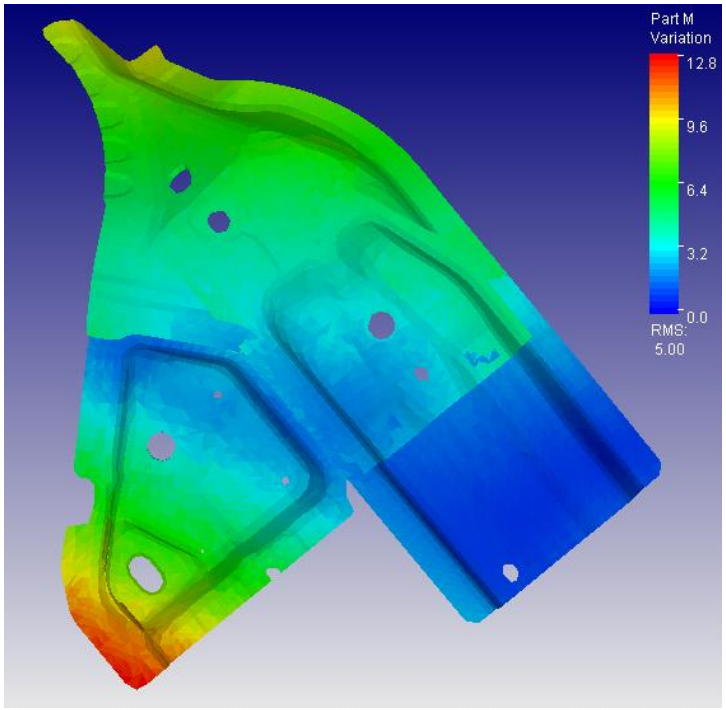


Assembly

Geometrisäkring / Variationssimulering



Referenspunkter och fästpunkter

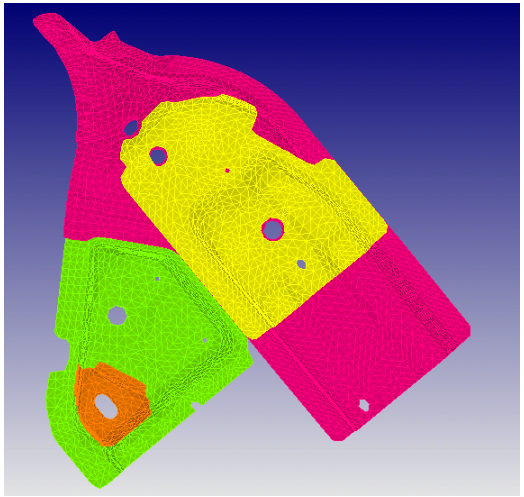


Variationssimulering

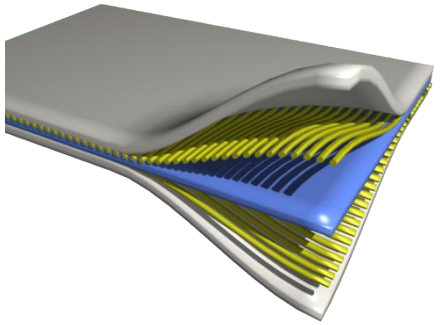
Fraunhofer ITWM
CHALMERS
Research Centre
Industrial Mathematics

Variationssimulering komposit

- Vad händer när fibrerna inte hamnar exakt som det var tänkt?

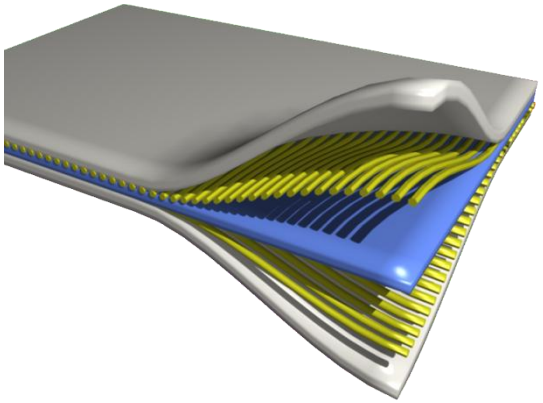


+



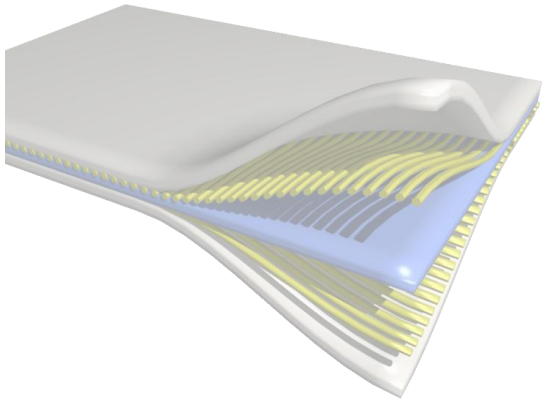
Summering, vilka kurser har jag nytta av i jobbet?

- Matte/Numerik
  - Linjär algebra
  - PDE, partiella differentialekvationer
  - Numerisk analys
  - Stora glesa matrisproblem
- Statistik
  - Statistical inference
  - Experimental design
- Programmering
  - MATLAB
  - Objektorienterad programmering
  - Högprestandaberäkning
  - Vetenskaplig visualisering
- Fysik/Mekanik



Summering, vilka kurser har jag nytta av i jobbet?

- Matte/Numerik
  - Linjär algebra
  - PDE, partiella differentialekvationer
  - Numerisk analys
  - Stora glesa matrisproblem
- Statistik
  - Statistical inference
  - Experimental design
- Programmering
  - MATLAB
  - Objektorienterad programmering
  - Högprestandaberäkning
  - Vetenskaplig visualisering
- Fysik/Mekanik



TACK!

Frågor?