

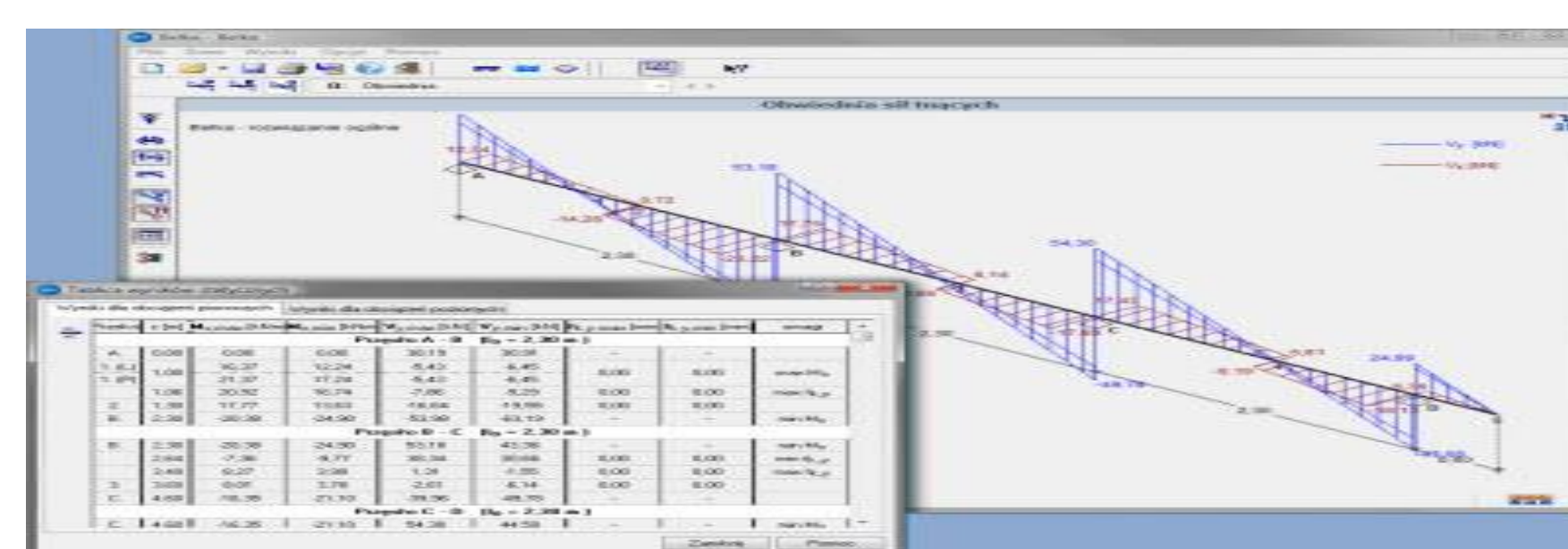
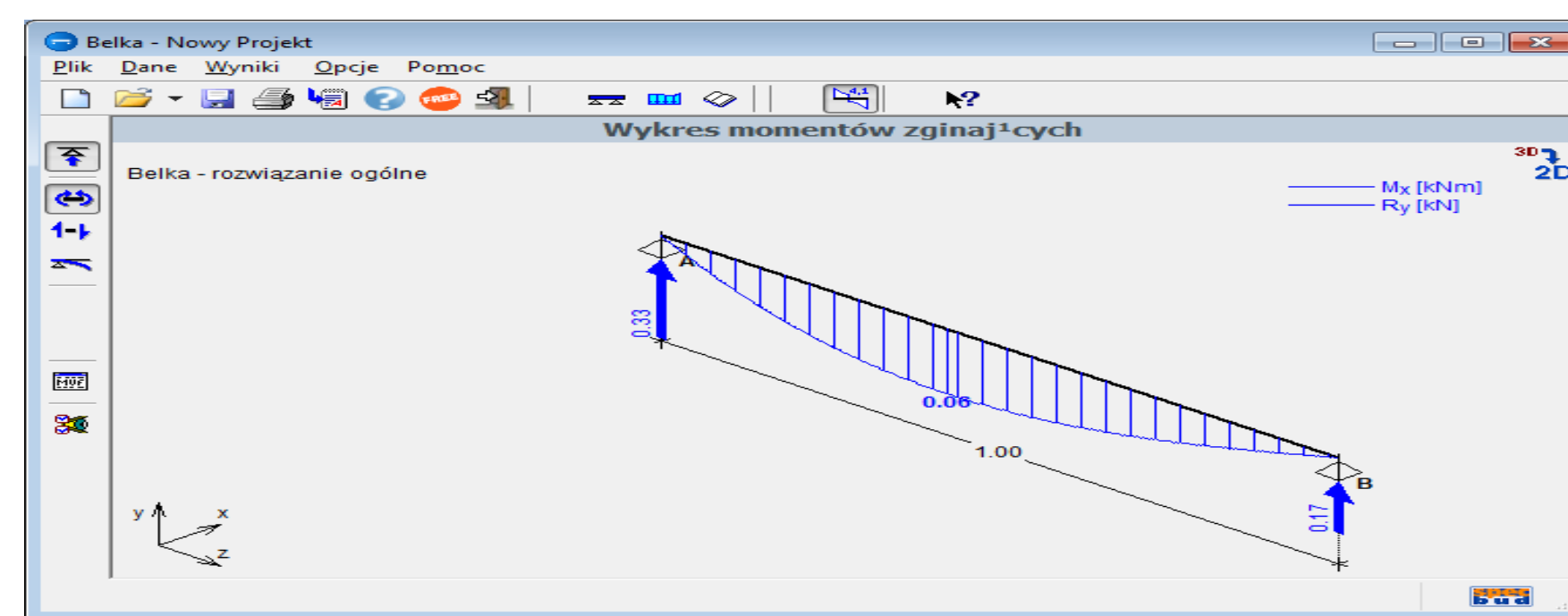


Modeling of Uncertainty in Computational Mechanics



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<http://andrew.pownuk.com>

FEM Software



Software development:
C, C++, Fortran, Delphi,
MPI, OpenMP, WCF,
Java, C#, Asp.Net, SQL,
Domain Specific Languages

M.Sc./Bs. Fundamental Technological Research

Specialty: Applied Mechanics

Faculty of Mathematics and Physics

Silesian University of Technology

Thesis:

Variational Equations

in the Theory of Torsion of Prismatic Bars

with Numerical Analysis

Institute of Theoretical Mechanics

Silesian University of Technology

Area of Interests:

Mechanics of Continuum

Theoretical Mechanics

Analytical Mechanics

Theory of Plasticity

Theory of Reliability

Numerical Analysis

Mathematical Methods in Engineering

Strength of Materials

Computational Science Ph.D. Program, UTEP
Supervisor: Dr. Vladik Kreinovich
Research area: uncertainty quantification

Silesian University of Technology
Ph.D. Thesis: Application of Fuzzy Sets Theory to Assessment of Reliability
of Civil Engineering Structures, defended 2001

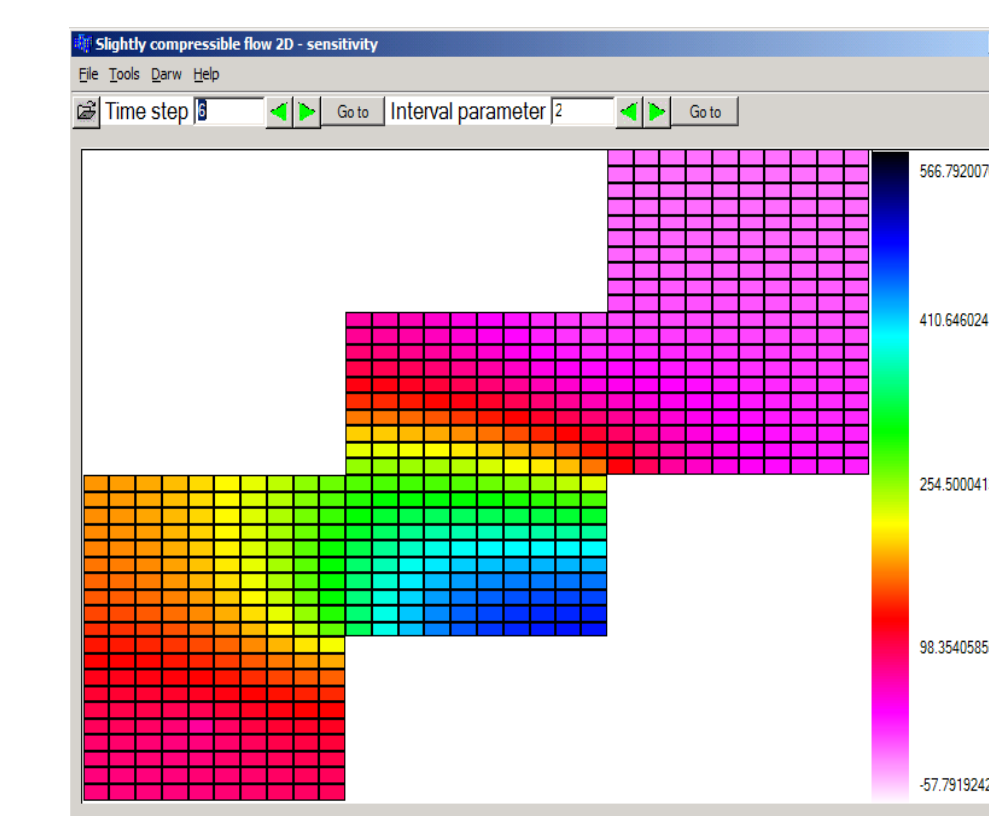
Modeling of Uncertainty in the Multiphase Flow for Chevron Corporation

Oil equation

$$\frac{\partial}{\partial x} \left(\beta_c k_x A_x \frac{k_{ro}}{\mu_w B_w} \left(\frac{\partial p_o}{\partial x} \right) \right) \Delta x + \frac{\partial}{\partial y} \left(\beta_c k_y A_y \frac{k_{ro}}{\mu_w B_w} \left(\frac{\partial p_o}{\partial y} \right) \right) \Delta y + \frac{\partial}{\partial z} \left(\beta_c k_z A_z \frac{k_{ro}}{\mu_w B_w} \left(\frac{\partial p_o}{\partial z} \right) \right) \Delta z = \frac{V_o}{\alpha_c} \frac{\partial}{\partial t} \left(\frac{\phi S_o}{B_o} \right) - q_{osc}$$

Water equation

$$\frac{\partial}{\partial x} \left(\beta_w k_x A_x \frac{k_{rw}}{\mu_w B_w} \left(\frac{\partial p_w}{\partial x} \right) \right) \Delta x + \frac{\partial}{\partial y} \left(\beta_w k_y A_y \frac{k_{rw}}{\mu_w B_w} \left(\frac{\partial p_w}{\partial y} \right) \right) \Delta y + \frac{\partial}{\partial z} \left(\beta_w k_z A_z \frac{k_{rw}}{\mu_w B_w} \left(\frac{\partial p_w}{\partial z} \right) \right) \Delta z = \frac{V_w}{\alpha_w} \frac{\partial}{\partial t} \left(\frac{\phi S_w}{B_w} \right) - q_{osc}$$

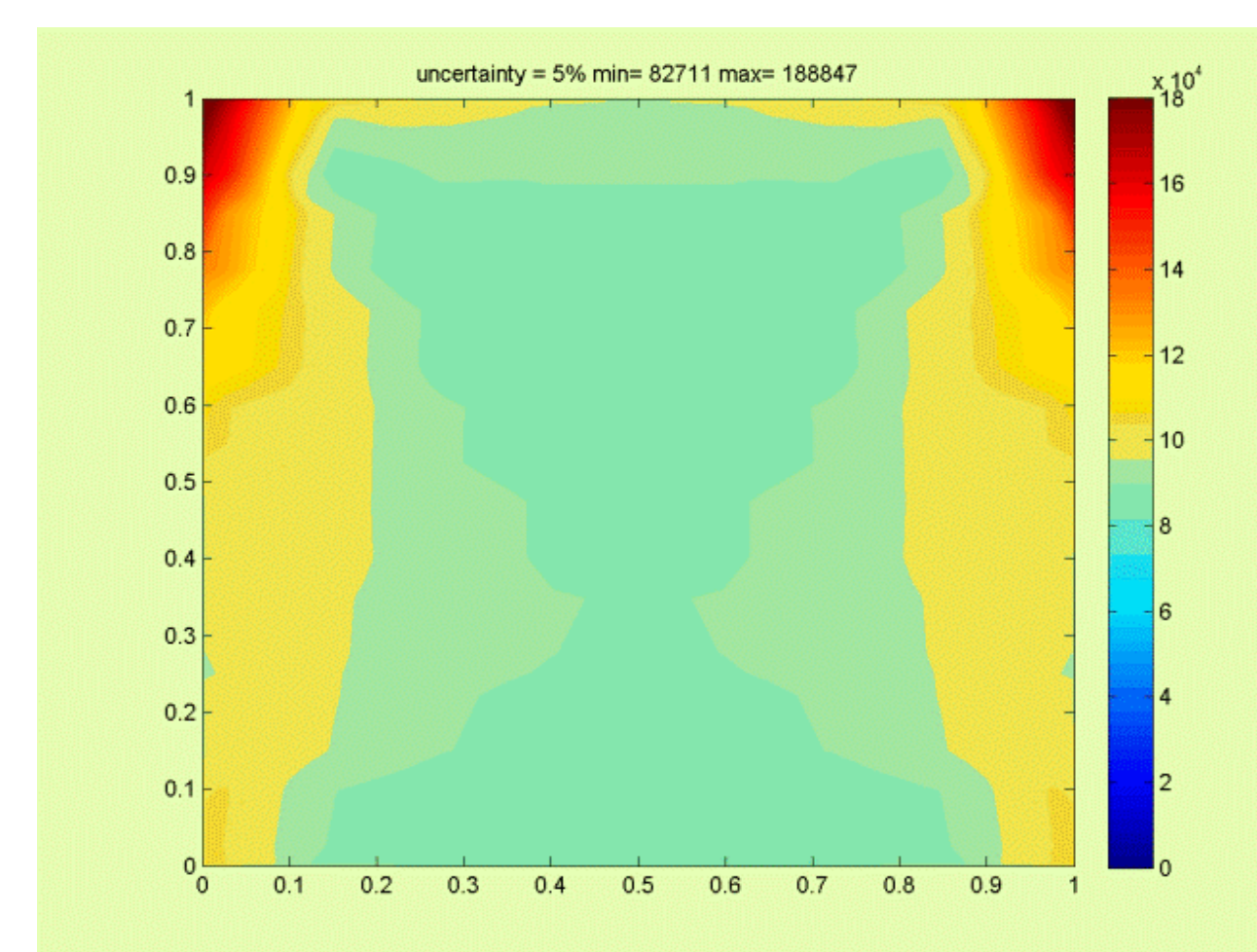


Interval and probabilistic uncertainty

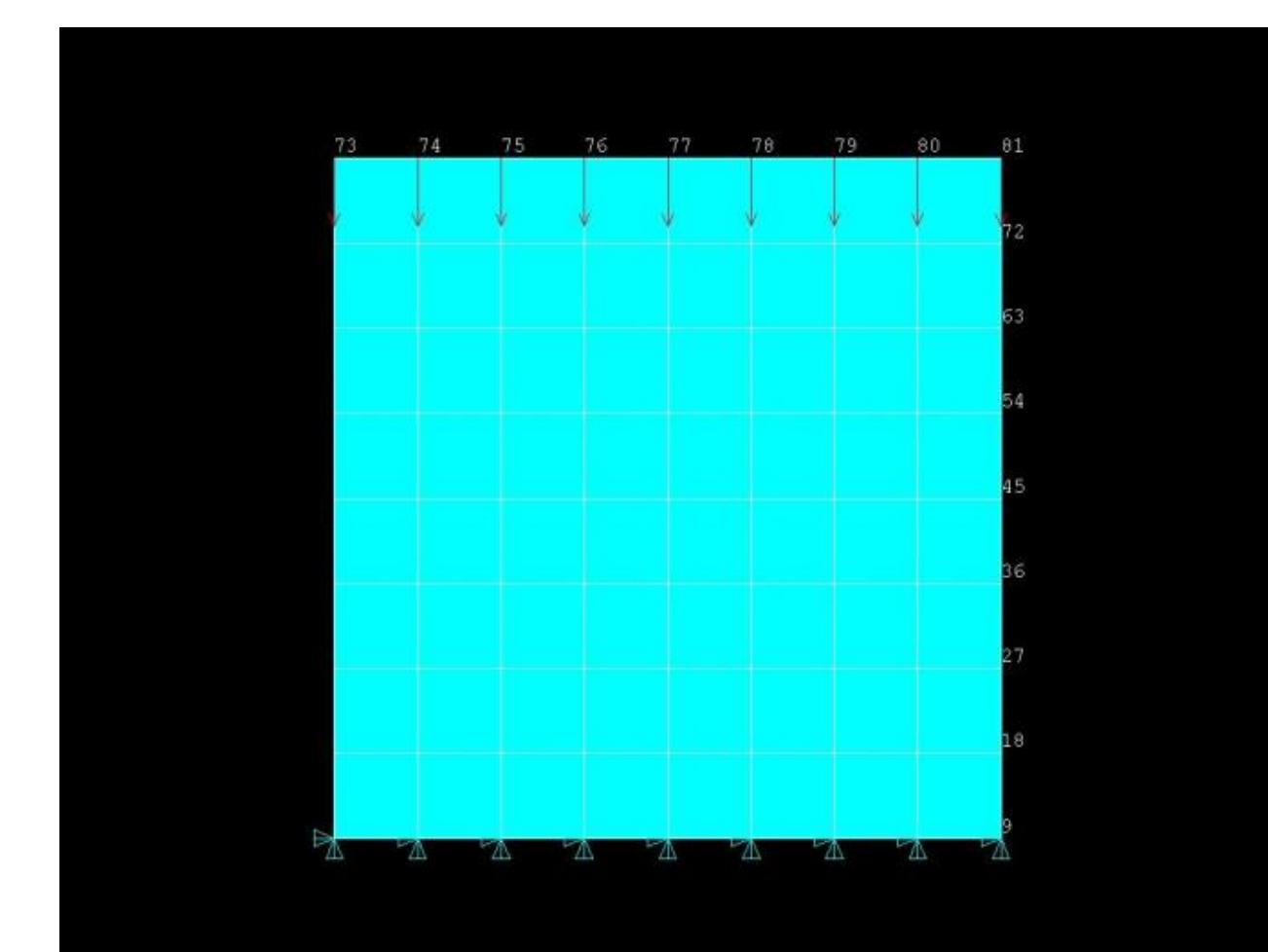
Solid Mechanics with Uncertainty

$$(\lambda + \mu) \nabla (\nabla \mathbf{u}) + \mu \nabla^2 \mathbf{u} + \mathbf{f} = \mathbf{0}$$

Pownuk A., Numerical solutions of fuzzy partial differential equation and its application in computational mechanics, Fuzzy Partial Differential Equations and Relational Equations: Reservoir Characterization and Modeling (M. Nikravesh, L. Zadeh and V. Korotkikh, eds.), Studies in Fuzziness and Soft Computing, Physica-Verlag, 2004, pp.308-347



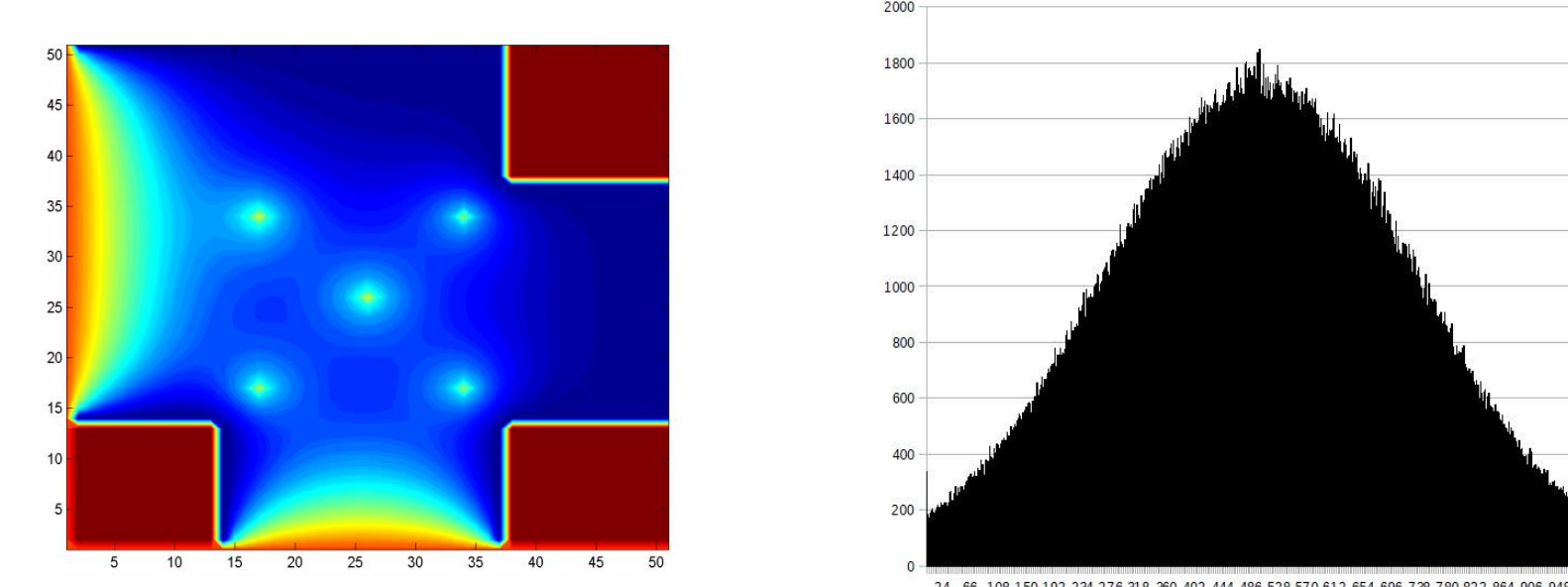
Uncertain stress



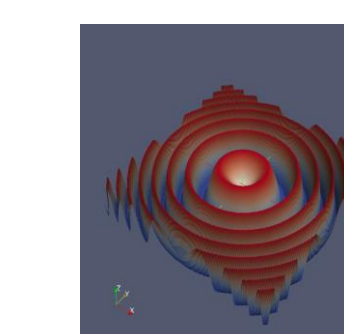
ANSYS model

COCONUT Project
Department of Mathematics
Faculty of Natural Sciences and Mathematics
University of Vienna, Austria

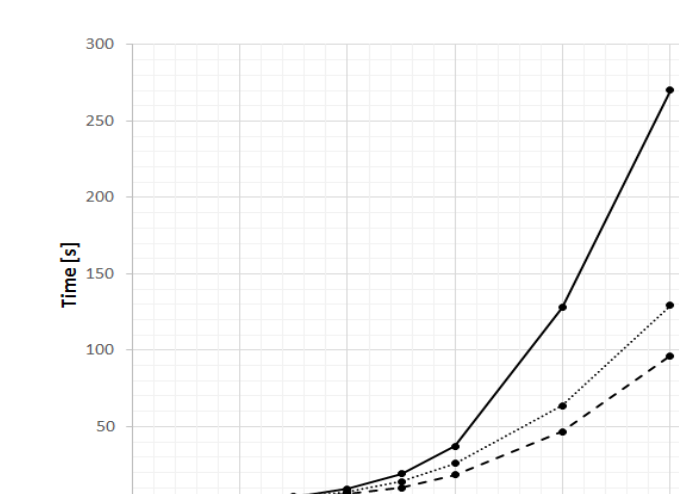
Neumaier A., Pownuk A., Linear Systems with Large Uncertainties with Applications to Truss Structures. Reliable Computing, Vol. 13, issue 2, 2007, pp.149-172



SAGA GEO Project
Scientific Computing with Algebraic and Generative Abstractions
Department of Computer Science
Bergen Language Design Laboratory
University of Bergen, Norway



M.S. Mathematics
The University of Texas at El Paso

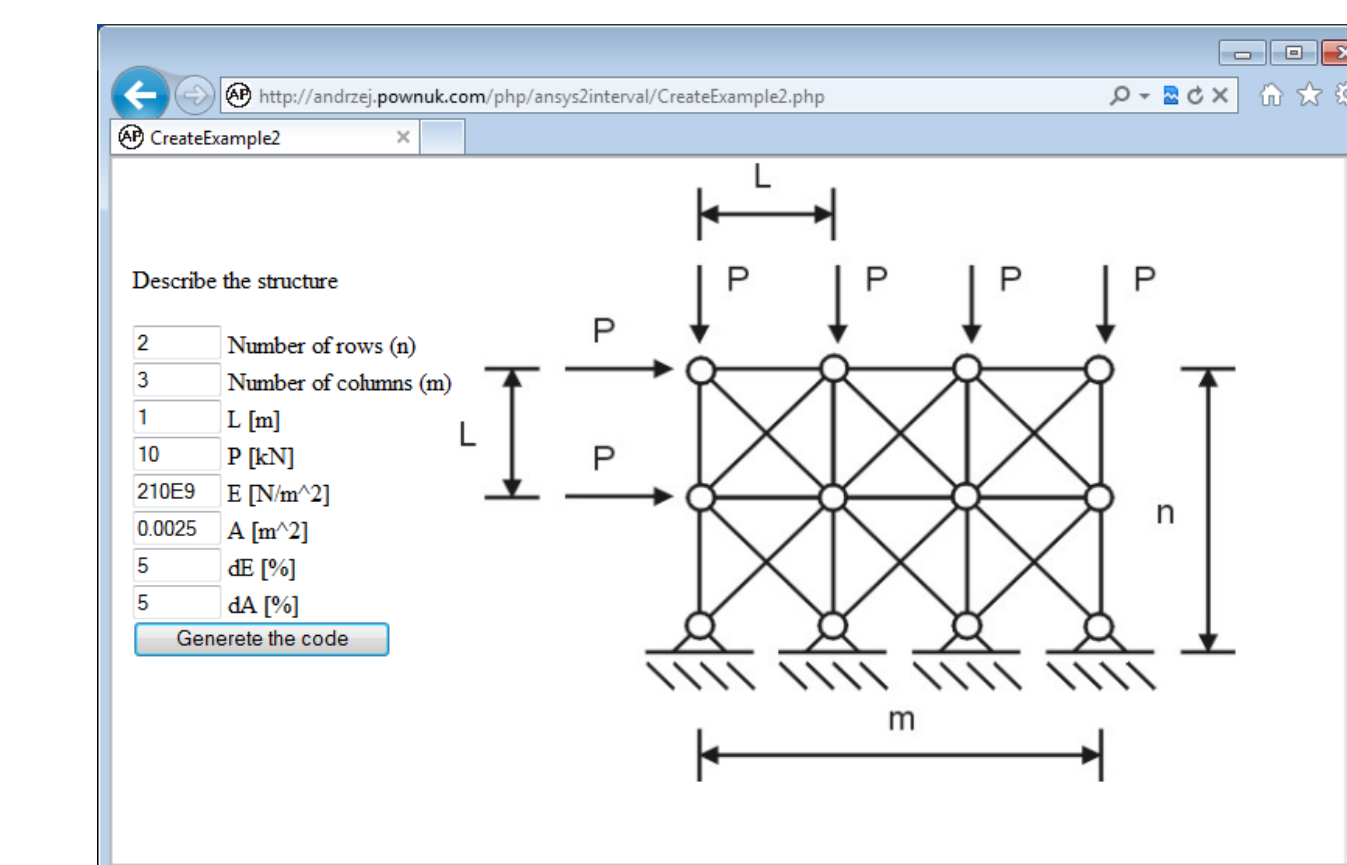


Other Software

Computer Science
(Computer Networks, Databases)
Silesian University of Technology

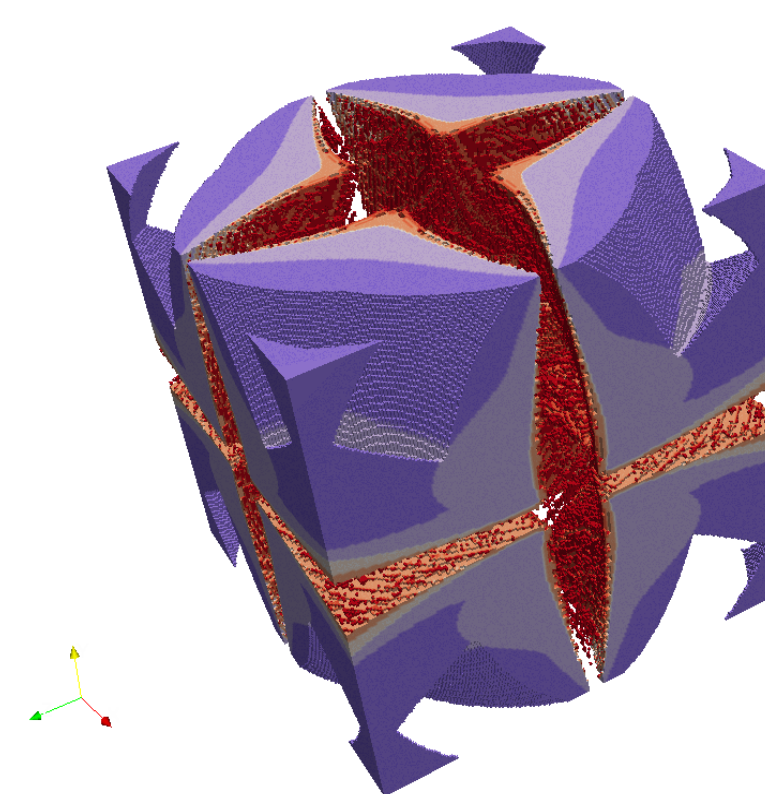
Thesis:

Web Application
for Teaching the Finite Element Method
(PHP, CGI, C++)

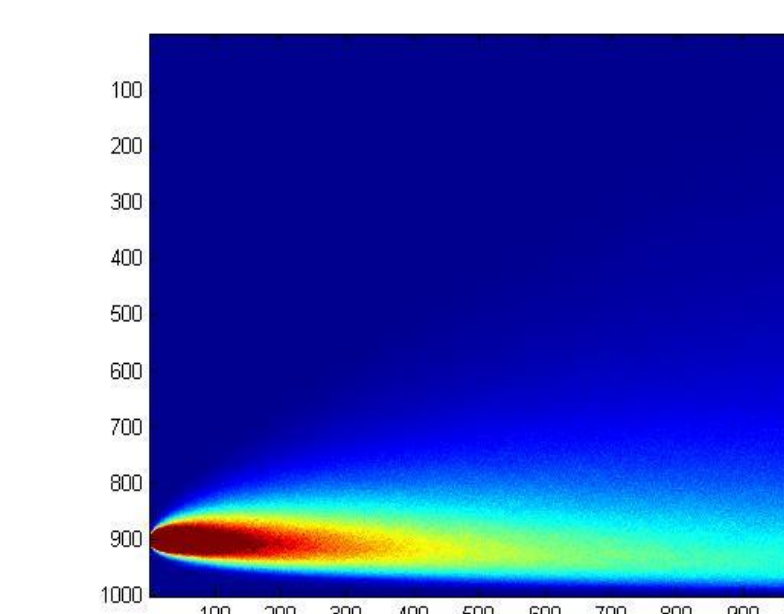


Online learning system (C#, Asp.Net, SQL)

Parallel methods
for solution of nonlinear equations
(MPI, C, Paraview)



Stochastic Differential Equations
(Matlab, C)



$$\begin{cases} dX = f(X)dt + g(X)dW \\ X(0) = X_0 \end{cases}$$