DEPARTMENT OF STRUCTURAL MECHANICS, Lodz University of Technology Chair of Structural Reliability		K-64 http://www.kmk.p.lodz.pl/?web=22
Head:	Potential promoters:	Contact person:
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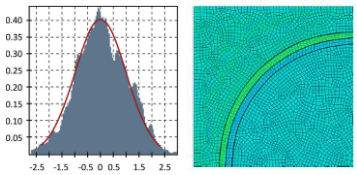
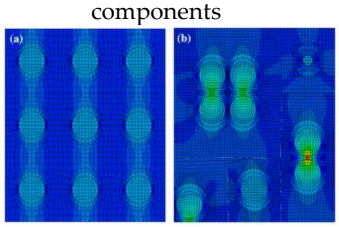
Main research activity:

[1] reliability analysis of the steel structures using the recommendations of Eurocode 0;
[2] development of implementations of the Stochastic Finite Element Method using the Promoters programs, and also using the FEM systems ROBOT & ABAQUS;
[3] computer modeling of the effective properties of the fiber-reinforced and particulate composites with random parameters;
[4] stochastic computer analysis of elastomeric, hyper-elastic and elasto-plastic materials;
[5] application of the computer algebra system MAPLE and programming language Python for software development of probabilistic and stochastic analysis;
[6] application of the Monte-Carlo simulation techniques and of the semi-analytical methods in analysis of engineering materials and structures with random parameters;
[7] applications for the students concerning structural reliability, durability and also for structural optimization.

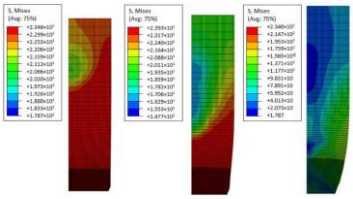
NCN project – probabilistic entropy



Composites with hyper-elastic components



Structural metals with microdefects



Current research:

[1] determination of probabilistic entropy in civil engineering structures and in hyper-elasic as well as elasto-plastic materials with material and geometrical imperfections;
[2] application of probabilistic entropy in reliability analysis and increasing for civil engineering structures;
[3] reliability analysis of civil engineering structures with random parameters and under stochastic dynamic excitation using the Second Order Reliability Method (SORM);
[4] computer implementations of the stochastic numerical techniques with the use of the FEM systems ROBOT and ABAQUS;
[5] numerical error analysis in the Stochastic Finite Element Method.

Future activities:

[1] analysis of probabilistic entropy in composite materials with non-periodic and anisotropic structure;
[2] application and computer implementation of probabilistic entropy in computer systems based on the Boundary Element Method, Finite Difference Method, and also on the Finite Volume Method;
[3] durability analysis of the steel structures (and other civil engineering structures also) subjected to random and stochastic environmental actions.

Publications/patents/awards/grants:

[1] M. Kamiński, On Shannon entropy computations in selected plasticity problems. *Int. J. Num. Meth. Engrg.***122**(18): 5128-5143, 2021;
[2] M. Kamiński, M. Strąkowski, Numerical simulation of some steel structural elements with uncertain initial porosity. *Metals* **11**(5), 689, 2021;

[3] J. Szafran, K. Juszczyk, M. Kamiński, Experimental and computational reliability analysis of structural joints in steel lattice tower. *Journal of Constructional Steel Research* **154**: 278-292, 2019;
[4] D. Sokołowski, M. Kamiński, Homogenization of carbon/polymer composites with anisotropic distribution of particles and stochastic interface defects, *Acta Mechanica* **229**: 3727-3765, 2018;
[5] D. Sokołowski, M. Kamiński, FEM study of a steel corrugated web plate girder subjected to fire. *Int. J. Appl. Mech. & Engrg.* **26**(2), 45-64, 2021.
[6] Patent No: PL239992B1; pt. "Hybrid telecommunication tower";
[7] Patent No: PL224881B1; pt. "Method of determination of effective material tensor components and their statistical characteristics for the periodic fiber-reinforced composites";
[8] NCN research project "Probabilistic entropy in engineering computations" OPUS no. 2021/41/B/ST8/02432 for the period 2022-2026;
[9] Fellowship from Polish Ministry of Education and Science for young researchers for dr eng. Damian Sokołowski.

Keywords:
Stochastic Finite Element Method, structural reliability, composite materials, homogenization theory, metal plasticity, hyper-elastic materials, strenghtening & reinforcements of steel structures.

Research proposals:
[1] development of stochastic software in Python and Java;
[2] computer analysis of thin-walled civil engineering structures in the FEM system ABAQUS and ANSYS;
[3] multi-scale computer simulations in Polish academic network PLGrid;
[4] experimental testing of aluminum structural elements;
[5] computer modeling of aluminum structures and simulation of their reliability.
Such a research stay may include some short term research visits in one of the following universities: [1] Politecnico di Milano, Włochy; [2] University of Messina, Włochy; [3] University of Porto, Portugalia; [4] New Jersey Institute of Technology, USA. Research stay may be associated with some additional funds according to the regulations of the National Science Center in Cracow, Poland.