Professor Zenon Mróz

See:
http://www.ippt.gov.pl/~zmroz/en/index_en.html

Member of the Polish Academy of Sciences
Department of Mechanics and Materials
Institute of Fundamental Technological Research
Polish Academy of Sciences

Fields of Research Activity:
Inelastic Analysis of Materials and Structures
Optimal Design and Sensitivity Analysis of Structures
Models of friction, slip and wear at contact interfaces

Education:
M. Sc. 1952, Dept. of Mechanical Engineering, Warsaw University of Technology,
Ph. D. 1959, Institute of Fundamental Technological Research,Polish Academy of Sciences, Warsaw,
D. Sc. 1965, Institute of Fundamental Technological Research, Polish Academy of Sciences, Warsaw,

Professional career:
1949-1952, Teaching Assistant, Warsaw Technical University, Chair of Theoretical Mechanics,
1952-1956, Design engineer of ship structures,
1956-1959, Research Associate at the Institute of Fundamental Technological Research, Warsaw,
1960-1965, Assistant Professor,
1965-1971, Associate Professor,
1971- to date, Professor at the Institute of Fundamental Technological Research, Warsaw,
2000-2004, Scientific Coordinator of the Excellence Centre AMAS (Advanced Materials and Structures)

Awards:

Awards of Polish Academy of Sciences: 1964, 1973.
National Award, 1968.
Koiter Medal Award, ASME, USA, 2004
Distinguished Medal of the Technical University of Cracow,1995.
Distinguished Medal of the Technical University of Bialystok, 2001.
Distinguished Medal of the Universita di Napoli, Italy, 2007

Honorary doctorates:

1995, University of Miskolc, Hungary,
1997, Faculte Polytechnique de Mons, Belgium.
1997, Technical University of Cracow, Poland.
1999, University of Waterloo, Canada.
2003, University of Minnesota, U.S.A.

Visiting Appointments:

1959-60, Visiting Post-Doctoral Fellow, Division of Engineering, Brown University, U.S.A.
1971-72, Visiting Professor, University of Waterloo, Solid Mechanics Division, Canada, (two semesters).
1978-79, Visiting Professor, Laboratoire de Mecanique des Ecole Polytechnique, France (8 months).
1979, Visiting Professor, University of Wales, Dept. of Civil Engineering, Swansea, Great Britain , (6 months).
1984, 1987, 1990, Visiting Professor, Virginia Polytechnic Institute and State University, Dept. Engin. Science and Mechanical Engineering, (one semester visits).
1985, Visiting Professor, Kyoto University, Dept. of Mechanical Engineering, (3 months).
1992, Visiting Professor, Laboratoire des Proprietes Mecaniques et Thermodynamiques des Materiaux, Universite Paris Nord, Valletaneuse, France (3 months).
1996, 1999, 2000, 2003 University of Minnesota, Dept. of Civil and Mineral Engineering, (6 months).

Research Areas:

1. Inelastic Analysis of Materials and Structures

Formulation and application of constitutive models for inelastic material behaviour with emphasis on cyclic, creep, and damage effects. In particular a multi-surface model of anisotropic hardening was proposed with account for memory effects in cyclic loading programs. A modified versions of this models were used in analysis of creep or creep-plasticity interaction problems. Various model of this type are actually being used in computer systems of inelastic analysis of structures. Similarly, for soils, the description of deformation processes was proposed and applied to simulate cyclic behaviour of soils, including liquefaction effect. The material damage theory applied to rock materials was used in description of rock burst phenomena accounting for rate-dependent damage accumulation.

2. Optimal Design and Sensitivity Analysis of Structures

Uniform variational approach was developed for both sensitivity analysis and optimal design problems with numerical algorithms based on optimality criteria. A wide class of optimal design problems was treated including material, shape, support, loading, and size variables.

The non-linear structure response due to physical effects and large displacements was considered in regular and critical states and the relevant design method was developed accounting for the admissible imperfection level.

Topology, shape and material design methods were developed using the concept of sensitivity forces driving the design process to proper optimal solutions.

3. Models of friction, slip and wear at contact interfaces.
The slip, wear and friction rules at material interfaces were analyzed accounting for dilatancy, anisotropy, and two scale asperity interaction. The memory rules for progressive and reverse slip events were incorporated by following the multi-surface plasticity concepts. Both damage and fracture accompanied by friction were considered. The constitutive models can be applied to interfaces in elastic regime and in plastic regime when plastic flow of asperities occurs combined with adhesive and abrasive effects, typical for metalworking processes. The progressive damage of thin layers was analyzed accounting for cracking and frictional slip at contact for both monotonic and cyclic loading.

Membership:

Member of the Polish Academy of Sciences (since 1986)
Foreign Member of the Hungarian Academy of Sciences (since 2001)
Foreign Member of the Lombardian Academy of Science, Italy,(since 2005)
Corresponding Member of the Polish Academy of Arts and Sciences (PAU), (since 2005)
Member of the National Committee of Mechanics, (since 1970), Vice-chairman of the Committee (since 1993).
Member of the National Research Council (1991-93).
Member of IUTAM Congress Committee, (1988-1996).
Overseas Fellow of Churchill College, Cambridge University (since 1980)

Member of Board of Editors of national and international journals:

National journals:
Archives of Machine Design,
Studia Mechanica et Geotechnica,
Journ. of Theoretical and Applied Mechanics,
Archives of Mechanics

International journals:
International Journal of Numerical Methods in Engineering,
Journal of Thermal Stresses,
Mechanics Based Design of Structures and Machines,
Int. Journal for Numerical and Analytical Methods in Geomechanics,
International Journal of Solids and Structures, 1990-2006.
European Journal of Mechanics, A/Solids,
Mechanics Research Communications,
International Journal of Geomechanics, ASCE.
Acta Mechanica,
Mechanics of Materials,1989-2007
Acta Mechanica Sinica,
Applied Mechanics Reviews (ASME),(1994-98),
Engineering Computations,
Archives of Computer Methods in Engineering,1990-2006.
International Journal of Engineering Analysis and Design,

Computers and Structures

Member of Scientific Committees of International Conferences:

IUTAM Symposium on Fracture of Brittle Disordered Materials, 1993, Australia,
Intern. Semin. "MECAMAT 92": Multiaxial Plasticity, Cachan 1992, France,
IUTAM Symp. on Optimal Design for Advanced Materials, Lyngby 1992, Denmark,
IUTAM Symp. on Optimal Control in Mechanics, Moscow, 1992,
Int. Workshop on Localisation and Bifurcation Theory for Soils and Rock, Grenoble 1993,
IUTAM Congress of Theoretical and Applied Mechanics, Haifa 1992, Israel,
Intern. Riso Symp. on Material Science: "Modelling of Plastic Deformation and Engineering Applications", Riso 1992, Denmark,
World Congress on Optimal Design of Struct. Systems, Rio de Janeiro 1993, Brasilia,
IUTAM Symp. "Microstructure and Properties of Composites, Aalborg 1994, Denmark,
World Congress of Struct. and Multidisciplinary Optimization; Goslar 1995, Zakopane 1997, Buffalo 1999, Dalian 2001.
IUTAM Congress of Theor. and Applied Mechanics, Kyoto, Japonia 1996.
AEPA-96, 98, 2000, Symp. on Advances of Eng. Plasticity, Hiroshima 1996 Seul 1998, Hong-Kong 2000.
11-th Europen Conference on Fracture, Poitiers, Francja, 1996.
IUTAM Symp. „Micro and Macroaspects of Thermoplasticity, Bochum, Germany, 1997.
IUTAM Symp. Free Boundary Problems, Paris, 1997.
Congress Theoret. Appl. Mechanics (ICTAM-2000), Chicago 2000.
IUTAM Symp. Analyt. Comp. Fracture Mechanics of Non-Hom. Solids, Cardiff 2001.

Organization of National and International Conferences:

Euromech Colloquium on "Mechanics of Granular Media", Warsaw, 1976.
IUTAM Symp. on "Optimal Structures Design", Warsaw, 1973.
Inter. Symp. on "Sensitivity Analysis and Optimal Design", Warsaw, 1987, 1990.
Euromech Colloquium on "Structures Under Variable Loads", Warsaw, 1992.
2-nd World Congress of Struct. and Multidisciplinary Optimization, Zakopane, 1997.
5-th Intern. Conf. on Biaxial/ Multiaxial Fatigue and Fracture, Cracow, 1997.
32. Solid Mechanics Conference, SolMec'98, Zakopane, 1998.

Books Published:

Recent Trends of Development of the Plasticity Theory, Pergamon Press-PWN. Coauthors: W.Olszak and P.Perzyna, 1968.

Mathematical Models of Inelastic Material Behaviour, Univ. of Waterloo Press, 1973.

Method of Limit Analysis in Soil and Rock Mechanics (in Polish), PWN, 1976. Coauthor: R.Izbicki.

Mechanics of Soils and Rocks,. Coauthors: W.Derski, R.Izbicki, I.Kisiel, Elsevier Sci. Publ., 1987. Polish edition, PWN, 1986.

Theory of Plasticity of Granulated Media, (in Polish) Ossolineum 1976. Coauthor: A.Drescher.

Numerical Methods in Mechanics, PWN, 1995 (in Polish), Ed. M.Kleiber. Author of two chapters. English edition by Springer (1997).

Comprehensive Structural Integrity, vol 2, Eds.B. Karihaloo and W.G. Knauss, 2003, author of chapter 2.01, Strength Theories, Elsevier.

Publications:
About 300 technical papers in international or national journals and conference proceedings. Authorship or co-authorship of 8 books and 10 unpublished research reports.