

WOJCIECH KRZYSZTOF NOWACKI
(1938–2009)

OBITUARY



PROFESSOR WOJCIECH NOWACKI, member of the Editorial Committee of *Archives of Mechanics* and Head of the Institute of Fundamental Technological Research of the Polish Academy of Sciences, passed away suddenly on 14th of August 2009.

Wojciech Nowacki was born in Mielec in Poland on 22nd of February 1938. In his life decisions regarding university education and professional career, Wojciech Nowacki continued the family tradition of his father Witold, who was outstanding professor of mechanics and a world-recognized researcher in the theory of thermoelasticity.

Wojciech Nowacki obtained his Master's degree in Civil Engineering from Warsaw University of Technology in 1961. His scientific career began with doctoral studies (1961–1965) at the Institute of Fundamental Technological Research (IPPT) in Warsaw where he obtained his Ph.D. degree in Mechanics in 1965. Since then, until his passing away in August 2009, IPPT was his home institute, with some parallel appointments at the Military Academy of Technology in Warsaw (1961–1969) and the Scientific Centre of the Polish Academy of Sciences in Paris (1972–1976). The milestones for his professional development were marked by the research positions held at IPPT: Assistant Professor (1965–1972), Associate Professor (1976–1982) and Professor (1982–2009).

Besides his research skills Wojciech Nowacki had organizational talent and exceptional human virtues that led him into several key positions at IPPT such as Director of the Centre of Mechanics and Information Technology (1996–2002) and Head of the Institute (2002–2009).

Wojciech Nowacki carried out extensive international cooperation dating back to his post-doctoral fellowships at École Polytechnique in Palaiseau (France) in 1969. Since then France became the destination of his frequent research stays, mainly at École Polytechnique Palaiseau, Université de Grenoble, Université de Poitiers, École Normale de Cachan and Université de Metz. He also cooperated with research centres and universities in Italy, Spain and Japan.

Professor Wojciech Nowacki was Editor-in-Chief of *Journal of Theoretical and Applied Mechanics*, member of the editorial boards of *Archives of Mechanics*, *Strength of Materials* (Problemy Prochnosti) and *Plastic Forming of Metals* (Obróbka Plastyczna Metali).

He was also member of the Polish Committee for Mechanics, Vice-president of the Polish Society of Applied and Theoretical Mechanics, member of the EUROMECH Mechanics of Materials Conference Committee, coordinator of the European Network of Excellence “Knowledge-based Multicomponent Materials for Durable and Safe Performance” (KMM-NoE), member of the Governing Council of the European Virtual Institute “Knowledge-based Multifunctional Materials AISBL” (KMM-VIN), member of the Committee of the Centre for Advanced Materials and Technologies (CAMAT), coordinator of the National Foresight Project “Poland 2020” and the foresight project “Scenarios of the development of modern metallic, ceramic, and composite materials of strategic importance to national development” (FOREMAT). He organized numerous scientific conferences and workshops including the important series of the Polish-French Symposia in the seventies of the last century.

Wojciech Nowacki’s work in mechanics was both theoretical and experimental covering a wide range of topics. During almost 50 years of his scientific career his research activity centred on three main themes: (i) propagation of stress waves in viscoplastic solids with account for the thermal effects, (ii) thermo-mechanical couplings in dynamic plasticity, and (iii) experimental methods in materials dynamics and impact.

He published over 170 journal and conference papers, 3 books including the widely cited monograph “Stress Waves in Non-elastic Solids”, Pergamon Press, Oxford, 1978 and edited 8 conference proceedings. He was the supervisor of four PhD theses.

The early papers of Wojciech Nowacki published in years 1962–1967 were concerned with propagation of stress waves and thermal shocks in elastic-viscoplastic bodies. In particular, he took part in the development (1967) of the new method of solving 3-D problems in dynamic thermoelasticity and thermo-viscoelasticity.

From 1968 to 1975 Wojciech Nowacki was investigating problems in thermo-viscoelasticity and thermo-elasto-viscoplasticity (with J. Zarka), waves in micropolar elasticity and three-dimensional problems of wave propagation in elastic-viscoplastic solids which constituted the bulk of his habilitation thesis defended at IPPT in 1975.

After the habilitation, Wojciech Nowacki's research interests followed two mainstreams: (i) constitutive equations and initial boundary-value problems in dynamics of inelastic solids, (ii) experimental testing of materials at wide range of deformation rates.

He proposed a constitutive model with discrete memory for materials manifesting hardening effects at high deformation rates which was a generalization of P. Guelin's model (1980) for cyclic loading and ideal hysteresis case. The discrete memory constitutive model was elaborated for a number of materials classes including isotropic and anisotropic metals, granular materials, polymers and shape memory alloys (e.g. NiTi). Also, based on the constitutive equations proposed by J. Mandel in the 1960's he derived respective equations for simple shear at large deformation rates and implemented them numerically.

An interesting research topic of dynamic compaction of soils, inspired by practical problems encountered in the construction of the first Polish nuclear power plant (not finished), attracted Wojciech Nowacki's attention in the mid 1980's. Together with his co-workers he devised and implemented numerically a mathematical three-phase model for the dynamic compaction of water infiltrated soils. The model took into account large strains and was endowed with nomograms for engineers to help them to determine the optimal distribution of explosives for the compaction of soil at large construction sites, e.g. power plants, harbour wharfs, etc.

Experimental testing of dynamic properties of materials at different strain rates was the domain which captivated Wojciech Nowacki for a long time. Experimental mechanics, inventing new measurement methods and devices were his favourable field of research over the last 20 years. It was also a field in which he achieved remarkable results. Most of that experimental work was carried out by a team of researchers from the Applied Plasticity Group at IPPT under his leadership. It should be stressed that these tests differed from standard characterisation tests of materials under static or dynamic loading conditions in that they measured not only mechanical properties but also thermomechanical couplings induced by deformation. Using thermovision camera for that purpose, routinely done for measuring temperature fields in static tests, posed a real experimental challenge when loading rates were high. A large number of dynamic tests capturing thermomechanical couplings were performed for a variety of advanced steels used in the automotive industry e.g. XES, DP, TRIP.

The most important achievement of Wojciech Nowacki in his investigations of the dynamic properties of materials was the design of a special device (1993) which made it possible to generate simple shear in a plate specimen when the set device-specimen was placed in the Hopkinson's bar system subject to compression. It was an ingenious idea which, for a majority of tested materials, led to homogeneous deformation up to very high deformation levels.

He also conducted experimental investigations and theoretical modeling of shape memory alloys such as NiTi, polymers (e.g. polyamid), polymer matrix composites reinforced with glass and biodegradable polymers (patent no. P.378103) for a large range of deformation rates.

In the last years he was actively involved in large European and national projects (KMM-NoE, KomCerMet, MATTRANS) on intermetallics, metal-ceramic composites and functionally graded materials. His specialty in these projects was characterisation of dynamic properties of materials and their fracture parameters.

Professor Wojciech Nowacki was an outstanding researcher who made a profound impact on the development of the dynamics of engineering materials. Affiliated for his whole professional life with the Institute of Fundamental Technological Research in Warsaw he largely contributed to its strength and international recognition. His hard work and relentless effort in recent years as Head of IPPT paved the way for the future development of his beloved Institute.

Professor Wojciech Nowacki will be missed by his coworkers, colleagues and friends. The author of this Obituary will always cherish Wojciech Nowacki's advice, support and friendship.

*Michał Basista
and the Editorial Board*
