
**SOLUTIONS FOR IMPROVED SEISMIC
PERFORMANCE OF NEW AND
EXISTING STRUCTURES**

Summary of the habilitation thesis

Aurel Stratan

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This habilitation thesis presents the main scientific, professional and academic achievements of Aurel Stratan following the defence of the PhD thesis in 2003 at the Politehnica University of Timisoara, as well as the future development plan.

The main research area of the author fits into the broad and multi-disciplinary area of earthquake engineering, with particular emphasis on seismic performance of steel structures and rehabilitation of existing buildings using metal-based solutions. The most important and relevant research directions pursued by the author are: "Re-centring eccentrically braced frames", "Cold-formed steel pitched-roof portal frames with bolted joints", "High strength steel in seismic resistant structures", "Seismic rehabilitation of existing reinforced concrete and masonry buildings with steel-based solutions", "Validation of the technical solution for braces with true pin connections", "Seismic performance of multi-storey steel structures with friction dampers" and "Prequalification of bolted beam to column joints with haunches". Experimental investigation methods represent the main tool of the research, supported at the same time by advanced numerical simulations and analytical tools. The habilitation thesis summarises the evolution of the research performed by the author following the defence of the PhD thesis, as well as the main outcomes, outlining also the context in which the research was performed, i.e. funding scheme, dissemination of results, and associated PhD theses. There were 12 grants supporting the research: 4 national grants, 7 international grants and 1 research contract with industry. The results were disseminated in 92 publications (journal and conference papers, and book chapters). Six PhD students were involved in the research (5 PhD theses were successfully defended and 1 is currently under development). Aurel Stratan had an active role in guiding the PhD candidates.

Professional development of Aurel Stratan followed a wide pallet of activities, including participation to training courses, structural design, industry-oriented research, involvement in professional organisations and technical committees, code drafting, development of the research infrastructure, organisation of scientific events, short-term scientific missions, involvement in administrative duties and peer-review of scientific publications. Though the author had a relatively limited involvement in structural design activity, it lead to important achievements, such as participation in the structural design of the Bucharest Tower Center, an office building with total height of 106.3 m, currently the third tallest structure in Bucharest. Aurel Stratan is member in several national professional organisations: AICPS, APCMR, AGIR-SBIS. He is also an active member in several national and international technical committees: Technical Committee TC13 "Seismic Design" of the European Convention for Constructional Steelwork (ECCS), CEN/TC 250/SC 8 "Eurocode 8: Earthquake resistance design of structures", CEN/TC 340/WG 5 "Revision of EN 15129 – Anti-seismic devices", ASRO CT 343 "Basis of design and structural eurocodes", CTS4 "Actions on structures", Ministry of Regional Development and Public Administration (MDRAP). The main work undertaken within these structures concerns improvement of national and European design guidelines in the field of earthquake-resistant design. Aurel Stratan is actively involved in maintaining and upgrading of the existing testing facilities in the laboratory of Steel Structures from the department of Steel Structures and Structural Mechanics. He was member of the scientific committee of three conferences, member in the organising committee of two conferences and chaired two sessions within international conferences.

In what concerns the academic area, Aurel Stratan teaches the courses of "Structural dynamics and earthquake engineering" and "Basis of structural design", as well as the project of "Steel structures" at bachelor level, and "Performance based design" and "Redesign of existing structures" at the master levels. All of them are supported by teaching aids developed by the author, which includes a book and electronic course notes posted on faculty website. Several diploma works and master dissertations are coordinated each year, the latter being correlated with the on-going research projects. The author was recently involved in teaching activities of

the European Erasmus Mundus Master Course "Sustainable Constructions under Natural Hazards and Catastrophic Events". He coordinated the module 2C09 "Design for seismic and climate changes" that were delivered in at the Politehnica University of Timisoara in the spring of 2014. Part of the lectures was delivered by Aurel Stratan at the University of Naples Federico II in March 2015, as part of the 2014-2016 edition of the European Erasmus Mundus Master Course.

In what concerns the future development plan, several new research directions are identified: extension of the concept of re-centring structures to dual Buckling-Restrained Frames (BRBFs) and Steel Plate Shear Walls (SPSWs), pseudo-dynamic and shaking table testing techniques, Buckling Restrained Braced Frames (BRBFs), seismic protection of buildings using passive and semi-active control, improved seismic design criteria for steel structures in case of ground motions with high frequency content in the long-period range, design criteria for connections in concentrically braced frames and prequalification of typical European connections, seismic vulnerability and risk assessment. Moreover, development of the international, national and industry-oriented cooperation is envisaged, as well as a more active role in grant applications and improvement of the research infrastructure. Last but not least, the teaching methods will be improved by involving the students through interactive learning techniques. Further development of the international cooperation at the academic level and continuing education are also targeted.