

SHORT SCIENTIFIC AND ENGINEERING BIOGRAPHY OF PROF. MELKUMYAN

Prof. Dr. Mikayel G. Melkumyan (born on June 10, 1951) started his scientific and practical activity in 1973, immediately after graduation from the Civil Engineering Department of Yerevan Polytechnic Institute, carrying out both design and experimental-theoretical research works to study the behavior of various reinforced concrete structures under seismic actions. In 1983 he defended his thesis for the *degree of Candidate of Engineering Sciences* and began to lead the Department of Earthquake Resistant Construction at the Armenian Scientific-Research Institute of Construction and Architecture. After the Spitak earthquake of December 7, 1988 in Armenia, Prof. Dr. Melkumyan dedicated himself to the deep analysis of consequences of this and other earthquakes and reasons for extensive destructions of various buildings and structures and, particularly, of frame-panel buildings.

From April 1990 through March 1991 he conducted research at the Institute of Industrial Science (IIS), University of Tokyo, where he was invited by Prof. Tsuneo Okada, Director of the Institute. Based on his experimental research works he created a *new hysteresis model (named «Melkumyan Model»)* to describe the shear behavior of rigid reinforced concrete structures (walls, diaphragms, shear walls, etc.). As it is indicated in the Certificate granted to him by the IIS, “this model and the formula proposed by Mikayel G. Melkumyan for calculation of horizontal stiffness of diaphragms were accepted at Okada and Nakano Laboratory, and the model was incorporated in the computational software for earthquake response analysis of multistory frame buildings with predominance of shear deformation”. The Certificate also acknowledges that “this research work will significantly contribute to the development of seismic engineering and earthquake damage mitigation in the world”.

After his return from Japan, from 1992 through 1996 he was a teaching Professor at the College of Engineering of the American University of Armenia (AUA), giving lectures on non-linear behavior of reinforced concrete structures and design principles in earthquake resistant construction. At the same time, he led the Earthquake Engineering Center of the National Survey for Seismic Protection (NSSP) under the Government of Armenia. In 1993 Prof. Dr. Melkumyan started his theoretical and experimental works on *development and application of seismic isolation systems* for buildings and structures in Armenia. Together with that, by the approval of the Government for the position of Director, he managed from 1993 through 1997 the Spitak Earthquake Zone Reconstruction Project, financed by the World Bank.

During a short period of time in 1995-1996, devoting himself to the challenge of increasing the earthquake resistance of existing buildings, he *developed two unique methods of protecting existing buildings from earthquakes* through base isolation, as well as by isolated upper floor and upper slab (roof isolation) without interruption of the use of the buildings. His innovative technologies were successfully implemented in Armenia, in the city of Vanadzor, where for the first time in the world a 5-story stone apartment building and over 60 years old 3-story stone school building, of historical and architectural value, were retrofitted by base isolation without evacuation of inhabitants and interruption of school functioning. Also, again for the first time in the world seismic resistance of two existing 9-story apartment buildings of standard frame-panel design was enhanced by the application of isolated upper floor. These works are unprecedented in the world practice of earthquake resistant construction of the time.

Later, his technology for seismic isolation of existing stone buildings (*Patent of the Republic of Armenia № 579*) was successfully applied in Russia during retrofitting by base isolation of a 100 years old bank building in the Irkutsk city. Using the same technology, he designed the base isolation system for retrofitting of a 180 years old municipality building in the Iasi city at the request of the Government of Romania. Prof. Dr. Melkumyan created unique base isolation technologies not only for low-story existing stone buildings, but also for multi-story existing frame buildings. These technologies were successfully applied in Armenia, in the city of Yerevan, for retrofitting of hotel and hospital buildings.

In 1997, he successfully defended his thesis for the *degree of Doctor of Engineering Sciences* on the subject of “Formation of the Dynamic Design Models for Seismic Response Analysis of Reinforced Concrete Buildings and their New Structural Solutions”.

In the period of 1997-1999 he was the Vice-President of NSSP. Starting from 2001 through 2010 he worked first as a Senior Research Associate and afterwards was promoted to the *position of Research Professor* at the Engineering Research Center of AUA. Being intensively engaged in the development of innovative structural concepts for construction of new buildings and retrofitting of existing buildings using created by him seismic isolation strategies, Prof. Dr. Melkumyan led the Center of New Construction Technologies at Armproject OJSC up until 2017.

During several years starting from 2003 he was developing and implementing a *new original approach in applying clusters of small size rubber bearings in isolation systems* of seismic isolated buildings. He successfully uses this approach up to date in his engineering works, which are widely recognized among scientists and engineers of many countries where seismic isolation has extensive application. Due to Prof. Dr. Melkumyan’s efforts to date **56 buildings and structures have been designed** by him with the application of base or roof isolation systems. These are structures of 1-story bathhouses, 5-18-story apartment, 2-3-story school, 3-8-story hospital, 5-7-story hotel and commercial center buildings and 20-story business center building, which is one of the tallest seismic isolated buildings in Europe. Of these designed buildings, the **total number of already constructed and retrofitted buildings has reached to 48, making the number of seismically isolated buildings per capita in Armenia one of the highest in the world** (second after Japan). From 1994, also due to Prof. Dr. Melkumyan’s efforts, Armenia started manufacturing high quality seismic isolators in accordance with international standards. To date the **number of already manufactured and tested** under his leadership *seismic isolators exceeds 5000*.

Prof. Dr. Melkumyan’s works in the fields of both non-linear behavior of reinforced-concrete structures and seismic (base and roof) isolation are well known to the international professional community. He has made a weighty contribution to the science and practice of earthquake resistant construction, having authored and co-authored **235 scientific works**, including **20 books, 11 normative documents, codes, and standards**, and **12 inventions**. Among them **5 monographs**: *Formation of the Dynamic Design Models for Seismic Response Analysis of Reinforced Concrete Buildings and their New Structural Solutions*, YEREVAN, 1993; *New Solutions in Seismic Isolation*, Yerevan, LUSABATS, 2011; *Non-Linear Behavior of Reinforced Concrete Structures under Seismic Actions*, Yerevan, LUSABATS, 2013; *Response of the Buildings under Dynamic Loading by Vibration Machine in Resonance Regime*, Yerevan, LUSABATS, 2018; *Seismic Isolation Strategies for Earthquake-Resistant Construction: Emerging Opportunities*, CAMBRIDGE SCHOLARS PUBLISHING, UK, 2019. 150 of his scientific works have been published in international journals and proceedings of the World, European, International and National Conferences in 33 countries across the world.

As a principal structural engineer or member of the designers' groups he has ***designed 100 earthquake resistant residential, civil, and industrial buildings*** for construction or retrofitting in different regions of Armenia and of Nagorno Karabakh, Romania and Kazakhstan including those with application of developed by him seismic isolation strategies.

At the request of the Republic of Armenia Ministry of Urban Development Prof. Dr. Melkumyan has developed the *Guidelines for Design and Construction of Buildings Using Laminated Rubber Steel Bearings*, and the Standard of the Republic of Armenia 261-2007 *Seismic Isolation Laminated Rubber Steel Bearing*. Both documents were adopted and approved by the Government of Armenia. In 2006 for the first time in the history of the Earthquake Resistant Construction Codes in Armenia a new Chapter 10 *Buildings and Structures with Seismic Isolation Systems*, also developed by Prof. Dr. Melkumyan, was incorporated in the RABC II-6.02-2006 currently in effect.

Prof. Dr. Melkumyan is the President of the Armenian Association for Earthquake Engineering, the Vice-President of the International Association of CIS countries on Seismic Isolation, a Founding and Honorary Member of the Anti-Seismic Systems International Society (ASSISi), Academic Member of the Saint-Petersburg Arctic Academy of Sciences, Academic Member of the Athens Institute for Education and Research, a Corresponding Member of Engineering Academy of Armenia, an overseas Member of the Research Center of Earthquake Resistant Structures of the IIS, University of Tokyo, a Member of the European Association for Structural Dynamics and European Association for the Control of Structures, a Member of the American Association for Science and Technology (AASCIT), a Member of the International Center for Urban Safety Engineering (ICUS), Supporting member of the International Council for Research and Innovation in Building and Construction (CIB) Task Group TG75 and of CIB Working Commission WC114 "Earthquake Engineering and Buildings". In 2019 as a prominent scientist Prof. Dr. Melkumyan is ***elected to the Committee of Eminent Experts*** of the International Research Base of Seismic Mitigation and Isolation in China.

He was a member of the Scientific and Organizing Committees of the numerous World, European, International and National Conferences. Prof. Dr. Melkumyan has organized and was the Chairman of the 8th World Conference on Seismic Isolation, Energy Dissipation and Active Vibration Control of Structures in 2003 and of the ASSISi International Seminar on Seismic Isolated High-Rise Buildings in 2006 (both held in Yerevan, Armenia).

By the frequent invitations Prof. Dr. Melkumyan has ***lectured and held master classes*** in China (1994), Indonesia (1994), Austria (1994, 2016), Iran (1995, 1999, 2009), Italy (1996, 2001, 2010), Georgia (1997), Syria (1998), Japan (1998, 2009, 2010, 2013), Turkey (2003, 2004, 2009), Vatican (2005), Romania (2007, 2010), Peru (2016).

He is a ***Member of the Editorial Boards*** of International Journal on Civil Engineering & Urban Planning (IJCEUP) of the Wireilla Scientific Publications, New South Wales, Australia, Journal of Civil Engineering and Architecture Research (JCEAR) of the Ethan Publishing Company, CA, USA, American Journal of Science and Technology (AJST) of AASCIT, International Journal on Engineering and Technology (IJET) of AASCIT, Journal of Architectural Research and Development (JARD) of the Bio-Byword Scientific Publishing, Sydney, Australia, Journal of Architecture and Construction (JAC) of Sryahwa Publications, Telangana, India, Sumerianz Journal of Scientific Research (SJSR) of Sumerianz Publication, Punjab, Pakistan. Also, he is a ***Member of the Structural Engineering Advisory Board*** of the Cambridge Scholars Publishing (CSP) Ltd, UK-Spain-Germany, and ***Associate Editor*** of the International Journal of Mechanical and Civil

Engineering of African - British Journals, GRA Ikeja, Lagos. He was the *Guest Editor* of the Special Issue "Advances in Seismic Performance Assessment and Improvement of Structures" of the Journal of Advances in Civil Engineering (JACE) at Hindawi, UK-Egypt-USA.

For more than two decades Prof. Dr. Melkumyan was advocating for the necessity of upgrading the earthquake resistance of buildings, constructed in the country before 1994, through his multiple publications in the mass media, by press conferences, interviews on TV and radio, as well as by presentations at the State Scientific Committee and Scientific-Technical Board under the Prime Minister of Armenia. He was trying to raise awareness on the risk of destruction of buildings constructed during the Soviet era and on the urgent need for seismic protection of critical facilities, such as schools and hospitals. With that consciousness in 2012 he founded the "Save the Yerevan Schools from Earthquakes" Foundation and in 2018 – "Melkumyan Seismic Technologies" LLC.

In different years (from 1998 to 2018) Prof. Dr. Melkumyan was a World Bank Consultant. He was a Consultant and then the Official Representative of the Armenian Fund USA, New York City (AFUSA) in Armenia, Consultant of the Tokyo Pacific Consultants International (PCI) for the ISMEP Project in Turkey.

His **fields of professional interests** are: non-linear behavior of reinforced concrete structures; earthquake resistant structures; seismic response analysis; construction technologies; seismic (base and roof) isolation; dampers; experimental investigations; modeling of reinforced concrete structures; testing of reinforced concrete structures; testing of full-scale buildings; testing of seismic isolation rubber bearings; strengthening of reinforced concrete structures; retrofitting of existing buildings by base isolation; upgrading the earthquake resistance of existing buildings by roof isolation; seismic risk assessment; seismic evaluation of existing buildings; seismic risk mitigation strategies.