# NONLINEAR SEISMIC ANALYSIS FOR REGULAR AND IRREGULAR STRUCTURES

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In past 20 years, several researchers have discussed the underlying assumptions and limitations of the pushover analysis. It has been found that, if a unique invariant force distribution proportional to the fundamental mode of vibration is assumed, satisfactory predictions of seismic demands are mostly restricted to regular in plane and in elevation low and medium-rise structures. Indeed, invariant force distributions are notable to take into account the redistribution of inertia forces due to yielding, and the associate change in the mode shape. Moreover, force distribution and displacement pattern related to the fundamental period of vibration do not account for the contribution of higher modes. To solve this drawback, Chopra (2003) proposed a method called modal pushover analysis (MPA), where the seismic demand due to the individual terms in the modal expansion of the earthquake forces is determined by a non-linear pushover analysis. To overcome the former limitations, and with the aims of bounding the likely distribution of interstory drifts and local ductility demands, seismic codes require that the analysis is performed enveloping the results obtained by using two different seismic force patterns: a load pattern aiming at reproducing the distribution of the seismic forces acting on the structure in the elastic state; an uniform or an adaptive load pattern aiming at bounding or reproducing the change in distribution of the seismic forces due to the progressive yielding of the structure. Numerical analyses performed in the last two decades have shown that the uniform load pattern is too conservative for the estimation of the response parameters for the lower floors of buildings, while all the adaptive load patterns proposed do not always succeed in providing a better estimation of the seismic response. In this context, in the proposed paper, firstly two very simple load distributions were proposed, one invariant and one adaptive. Each of the proposed load distributions is effective in bounding the seismic response of the structure without introducing the large overestimation of the seismic response. Regarding irregular structures, a modified version of the modal pushover in which correlation rule that takes into account the non-linear behaviour of structures is proposed. The effectiveness of the proposed load distributions are proved by comparison with the results provided by several lateral load distributions prescribed by international codes.
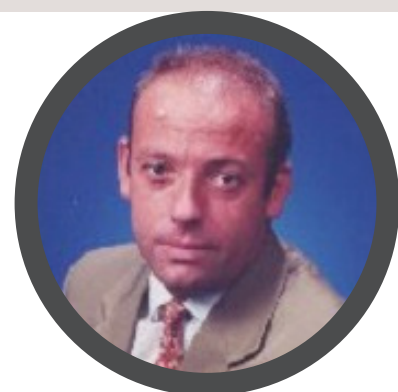
Biography

Piero Colajanni is currently serving as an Associate Professor of Structural Engineering at the DICAM, University of Palermo. He has completed his Msc in Civil Engineering in 1990 and PhD in Structural Engineering in 1995 from Palermo University. He was a Visiting Assistant Professor at Florida Atlantic University, Department of Mechanical Engineering in 1996 and a Researcher of Engineering and Solid Mechanics in 1997, and an Associate Professor in Structural Engineering in 2001 at University of Messina. In 2013, he moved to University of Palermo, where nowadays teaches building structural analysis and design, and seismic design of buildings. He was Promoter and President of the Scientific Committee of Master in Seismic Engineering at University of Messina in 2003 and 2006. He is the author of more than 150 papers on international and national journals, and conference proceedings. His research activities include in the fields of Structural Engineering and Seismic Engineering, focused on procedure for seismic design, vulnerability assessment and retrofitting of buildings, the use of innovative devices and materials for seismic protection of new and existing structure and design of hybrid steel truss concrete beams.

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