NON LINEAR ANALYSIS OF RC STRUCTURES, PERFORMANCE BASED SEISMIC DESIGN AND DISPLACEMENT BASED DESIGN APPROACHES

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The research group is involved in the development of new analytical models and in the implementation of original computer programs for the nonlinear static and dynamic analysis of reinforced concrete (RC) structures. The prediction and the control of the inelastic response represent, indeed, fundamental elements of the seismic design. The research started with the realization of a new global model based on the subdivision of the elements in segments. Subsequently it has been proposed a new fibre model based on the flexibility approach and the MCFT theory as constitutive relationship, able to account for the nonlinear flexural-shear interaction of RC members. The models have been then applied for studying various aspects of the nonlinear seismic response of RC structures. The pushover analysis, that is a non-linear static analysis performed by applying lateral forces gradually increasing up to collapse, may provide an alternative both to conventional linear methods and to more complex methods based on non-linear dynamic analyses.

In recent years innovative methodologies have been proposed for the seismic design of building structures, such as Performance Based Seismic Design (PBSD) and Displacement Based Seismic Design (DBD). The core idea of the PBSD (PEER, Vision 2000, California) resides in the capacity of defining and satisfying a number of given performance objectives (association of a structural performance level to an earthquake design level). The new concept introduced by the DBD (Priestley and Calvi) lies in the development of a design method based upon the displacements (instead upon the forces).

Some of the studies performed by the group have been aimed to the validation of the DBD methodology developed by Priestley and Calvi with reference to new and existing RC structures. Within the related research projects a collaboration is activated for the preparation of a model code and examples. Moreover extensions of the DBD procedure have been proposed for asymmetric structures and infilled RC frames.

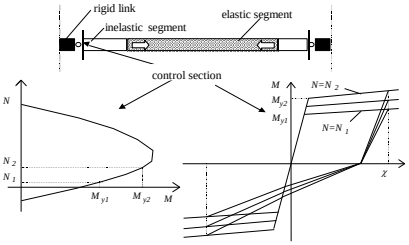

Fig. 1. Spread plasticity model with degradation (Landi).

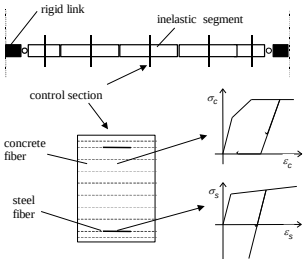

Fig. 2. Fibre model (Landi).

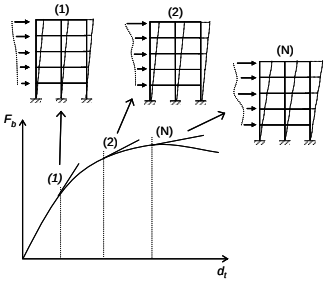

Fig. 3. Adaptive pushover analysis (Landi).

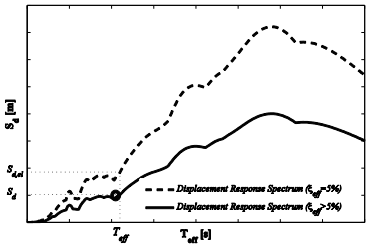

Fig. 4. Displacement spectrum (Landi).

MAIN PUBLICATIONS

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RESEARCH PROJECTS

Research project RELUIS3, Line 7 (2014-2016): "Development of displacement based approaches for the seismic loss assessment in the pre and post-retrofit condition", task of Bologna: "Post-1970 RC buildings". Research project RELUIS2, Line 2 (2010-2013): "Development of displacement based approaches for the vulnerability evaluation", task of Bologna: "Reinforced concrete structures with and without masonry infills" National Coordinators: Prof. G. M. Calvi and Prof. T. J. Sullivan; Resp. of the Bologna Unit: Prof. A. Benedetti.

National Research Project PRIN (1999-2001): "The safety of reinforced concrete structures under seismic actions with reference to design criteria of resistance to collapse and damage limitation of Eurocode 8" Local Resp.: Prof. P.P. Diotallevi; National Coordinator: Prof. A. Castellani.

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