Introduction

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Biographical notes: Franco Bontempi made his Military duty in 1989. He holds degree in Civil Engineering (1988) and a PhD in Structural Engineering (1993) from the Politecnico di Milano. He is a Full Professor of Structural Analysis and Design at the School of Engineering of the University of Rome La Sapienza since 2000. He is also a Visiting Professor at Harbin Institute of Technology (China), and a Visiting Assistant Professor at University of Illinois at Urbana-Champaign. He did his research period at Technische Universitaet di Karlsruhe and Technische Universitaet Munich. He has published more than 220 scientific papers about: safety and reliability, computational mechanics, nonlinear and stochastic mechanics, dynamics, identification, optimisation and control. He is a consultant for bridges, tall buildings, special structures, and forensic engineering.

When I was a young student of Structural Engineering in the middle of the '80s – last century, in one of the most prestigious Italian universities, I was committed to scrupulously study the safety assessment of structures by the then newly introduced Limit States format, focusing on meticulous but (yet) local assessment. I was never able to develop a good feeling for that approach, because I was not able to feel the structure as a whole, and in fact, only years later, with great difficulty, I reached a fairly good sense for the conception, the design and the analysis of structures. Furthermore, the presumption of the rigorous probabilistic approach according to this safety format with an evident lack of data was never satisfying to my eyes.

With time, I became aware that opposed visions of the same problem were developed and used elsewhere. Essentially, more global, even holistic approaches were considered, able to express the quality and performance of the structure as a whole and considered as a system surrounded by an interacting demanding environment, with uncertainty not amenable of statistical description and facing a quite unpredictable future.

Following these consideration, the necessity to introduce a new vocabulary was apparent, with terms such as performance-based design (concerning the quality of structures) and life-cycle (focusing on the whole life of the structure, from conception and construction to demolition and reuse). These are just the words that constitutes the title of this journal!

In terms of structural safety, the attention of the engineering community was progressively attracted by global and broader characteristics. In this sense, qualitative properties such as robustness were found to be equally important, or even more, than quantitative checks. Absurd terroristic attacks forced all of us to reconsider the way to assess and guarantee the structural safety, while the same intrinsic quality of soundness is also required for ageing constructions located in an aggressive environment.

2 F. Bontempi

For all these considerations, this special issue of the *International Journal of Lifecycle Performance Engineering* is devoted to structural robustness, here intended as the ability of a construction to develop a stable (or even decreasing) structural response to damage: above all, a structure is robust if an initial damage does not lead to disproportionate collapse.

In this issue, distinguished authors with different backgrounds were asked to present their point of view and experiences, and to develop a personal, but at the same time vivid interpretation of this topic.

Specifically, the paper 'Robustness of structures' by Uwe Starossek and Marco Haberland defines fundamental concepts and basic terminology, while the paper 'Structural safety in case of extreme actions' by Luisa Giuliani applies these ideas to specific cases, with examples, voluntarily simple, that lead to a detailed assessment of robustness characteristics and comparison among different structural schemes.

The third paper of this issue, 'The influence of degradation phenomena on collapse modes in prestressed concrete beams' by Luca Sgambi, Pier Giorgio Malerba, Giordano Gotti and Diego Ielmini, presents a study of a prestressed concrete structure where emphasis is given to the change of collapse modes between the nominal and the damaged configuration.

Finally, the paper 'Reliability based approach for structural design and assessment: performance criteria and indicators in current European codes and guidelines' by Stefania Arangio highlights the difficult role of standards in coding the more multifaceted quality required for today's constructions.