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ICEAF-IV Engineering Against Failure

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Editorial Theoretical and Applied Fracture Mechanics Special Issue ICEAF IV

Prevention of unexpected failures is a fundamental design objective in any engineering structure or system. Nevertheless, the complexity of modern structures and the interactivity among engineering systems, coupled with human fallibility means that failure and its consequences can only be avoided to a statistical probability. Hence occasional catastrophic failures will occur with some of them involving the loss of human lives. Within the last few decades, a dramatic advancement has been achieved in many of the necessary technologies to either avoid or mitigate the consequences of failure. This advancement is associated with ever-increasing performance objectives for materials, structures, and machines, an increased complexity of engineered products and processes. Alongside this, catastrophic failure and its consequences are considered less tolerable in society as a whole; this ensures that efforts to prevent unexpected failures are now a cornerstone in modern engineering design and, simultaneously, a technological and scientific challenge. There is an increasing acknowledgement in the engineering community that the response to this challenge, that is, prevention of catastrophic failure, generally requires a systems approach and necessitates engagement of a large pool of multidisciplinary expertise and the deployment of tools for systems analysis, e.g. failure mode and effects analysis, fault tree analysis and the failure mandala approach developed by Hatamura and the Japan Science and Technology Agency[1]. This multidisciplinary pool includes materials science, structural analysis, manufacturing technologies, quality control and evaluation, mathematics, physics, and probability and reliability. Furthermore, from the scientific point of view, there is also an increasing acknowledgement that addressing the complex engineering problems of today requires the use of concepts and approaches that can account for size and time scaling effects. The series of International Conferences of Engineering Against Failure (ICEAF) aims to provide, on a biennial basis, a forum where the relevant scientific and technological achievements can be presented and discussed with an audience of international experts drawn from academia and engineering industry. The conference scope embraces interdisciplinary work aimed at understanding and deploying physics of failure techniques[2], advancing experimental and theoretical failure analysis, modelling of the structural response with respect to both local and global failures, and structural design that accounts for scale and time effects in preventing engineering failures.

The fourth International Conference of Engineering against Failure (ICEAF IV) was held in Skiathos, Greece over 24–26 June 2015. This successful event attracted more than 150 high quality presentations and around 200 participants from all over the world. A special session of the conference was dedicated to Prof. Paolo Lazzarin who passed away in September 2014. The session was entitled: *Recent developments in studies on cracks and notches: criteria for fracture and fatigue assessment.* As a number of the papers presented at that conference session dealt with aspects of fracture mechanics and fatigue, it is appropriate to arrange for their publication of a Special Issue of the Journal of Theoretical and Applied Fracture Mechanics. Following a strict peer review process, a limited number of conference papers were selected to be extended and published in this Special Issue. The selected papers touch different important topics in fatigue and fracture of structural materials. As the guest editors of this Special Issue, we believe that the final result will have significant value to researchers and designers who are working on the demanding objective of engineering against failure. We would like to thank all authors for their contributions and the reviewers for their trouble taken in ensuring high quality publications. Sincere thanks are also due to Professor Luca Susmel, the Editor-in-Chief of this International Journal, for his help and support,

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[1] Hatamura Y (2005), Structure and expression of failure knowledge database, http://www.sozogaku.com/fkd/en/infen/mandara.html (accessed 12/11/2015).

[2] Physics of failure is an area of increasing interest that is concerned with developing a science-based approach to achieving ultra-high reliability (see, for example, Deckert M W, Physics of failure, Program Manager, September-October 1994 pp.42-46, ISSN 0199-7114 http://www.dau.mil/pubscats/pubscats/PM/articles94/decker.pdf). It is finding applications from electronic systems and components to gas turbine discs.

and to Kumar Aravind and Lv Grace for their valuable support during the preparation of this Special Issue volume. A special thank you also goes to the organizers of the conference and in particular to Professor Spiros Pantelakis for making this very successful conference possible.

November 2015, Vicenza, Italy and Plymouth, England

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