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**Title:** Behaviour of complex systems under random damage

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## Abstract

Damage tolerance has been shown to be a fundamental prerequisite for the safety and the robustness of large complex systems [1]. Modern requirements for construction design consider mandatory to provide structures with alternative load paths able to maintain structural integrity, in order to deal with progressive degradation and reduce the probability of failure. Although it has been shown that systems in parallel exhibit robust characteristics if structurally complex [2], no specific studies devoted to the critical analysis of the mutual effects of complexity and robustness on mixed systems have been proposed. In this study, the structural response of a simple system made of rods in series and parallel configurations is analysed. To highlight the redistribution capabilities, damage on the system is considered. Strain energy is regarded as the functional that better describes the effects of damage on the system [3]. The paper aims both to highlight the behaviour of rods working in the coupled mechanism and to define a possible strategy to sustain damage acting at random on one element. The behaviour of the complex system result statically indeterminate due to the presence of multiple load paths able to redistribute and absorb the effects of damage. The outcome of the analysis highlight that, even each component of the system (mechanical characteristics of materials, acting loads, etc.) behaves linearly, the structural response of the system under progressive damage is not linear. In addition, as much the complexity increases the possibility to handle with the consequences of the random damages improved.

## References

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