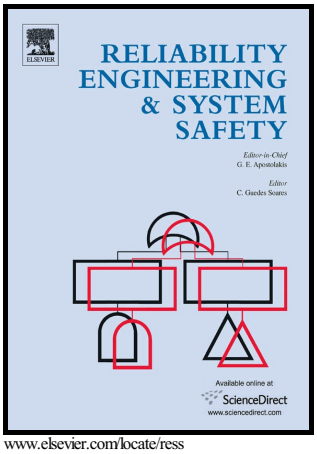

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Defining the Functional Resonance Analysis space: combining Abstraction Hierarchy and FRAM

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Abstract

System-thinking and related systemic methods enhance traditional risk and hazard assessments and accident analysis, as well as system design. The Functional Resonance Analysis Method (FRAM) is a recently developed method for systemic analysis. FRAM facilitates descriptions of the functional relations among system elements. In case of large systems (e.g. several agents, multiple procedures, many technical equipment), building a FRAM model may become a difficult task, moreover resulting in a complex model, with limited benefits for the purpose of the analysis.

Considering complexity as strictly dependent on the resolution of the representation, this paper explores the compatibility of the Hollnagel's FRAM with Rasmussen's Abstraction Hierarchy (AH). Starting from the AH's traditional Abstraction/Decomposition division, this study conceptually explores the benefits arising from combining an Abstraction/Agency framework with system-thinking, in particular with FRAM. This combined approach, which allows systemic functional analysis at different levels of abstraction and among different agents, for the development of a systemic multi-layer functional structure, useful for intra-agent inter-level and intra-agent intra-level analyses. An application of the framework in the railway domain illustrates some conceptual outcomes of the approach, confirming the relevance of FRAM's fractality as well as the potential for enhanced knowledge representation associated with a multi-dimension approach.

Keywords: Functional resonance; knowledge representation; complexity; systemic approach; fractality.