Structural Systemic Method for Dealing with Part Failure Impact on Mechanical Subset's Neighboring Parts

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Abstract

From a systemic managerial perspective or ideology allowed for contemporary companies through Re-engineered 4th Generation Management (Hallioui et al., 2022)—sustainability, competitiveness, and productivity are crucial matters for each company worldwide to strive as a whole to achieve its strategic goals. We expect that will shortly make a broad debate and framework for an increasingly growing number of research works in the business world and academia. Furthermore, that motivated us to open the research interval to the system approach to transit from the

company's behavior management to the structure of production systems, indeed, from a managerial application for the company to the equipment structure and that of the mechanical system, particularly. Therefore, this paper aims to suggest a new, innovative, and dynamic method to apply to mechanical systems for systemic decision-making in maintenance and acting efficiently on the impact of their failures and limiting its consequences on the production processes where these mechanical systems or their subsets are operated. This method is called Structural Systemic Method (SSM) and is based on Fault Tree Analysis and contemporary maintenance or non-systematic proactive maintenance strategies (e.g., condition-based and predictive maintenance). It is an answer to a two-fold research gap, the limitations of Failure Tree Analysis as a quasi-systemic technic and the only structural method in maintenance literature to deal with parts' failures; and systematic preventive maintenance (i.e., time-based maintenance) as a traditional maintenance strategy. In other words, Structural Systemic Method is a failure interaction, prevention, and detection-based maintenance method that will deal with a part's impact on the neighboring parts of the same mechanical subset. The expected results of this work as a pioneer to present SSM are allowing systemic decision-making in maintenance; adapting the maintenance function to the need of contemporary companies within their current context of Industry 4.0, Circular Economy, Competitiveness, and Diverse Stakeholders (Hallioui et al., 2022); reducing the number of maintenance interventions; reducing the maintenance costs; optimizing the maintenance resources; enhancing the maintenance efficiency and value for companies; increasing the understanding of complex systems' maintenance, and improving the mechanical systems' performance; and proving the SSM's ability to predict the failure root causes' impact of a part on other ones on a well-determined interacting subsystem as early and quickly as possible while considering the holistic behavior of mechanical systems, which contributes directly to improving their dependability, and therefore their effectiveness and longevity over time.

Keywords
System approach, equipment structure, systemic decision-making, Structural Systemic Method (SSM), contemporary maintenance, Failure Tree Analysis.

References

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Biographies

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