

# Orthogonal Defect Classification-based Ontology Construction and Application of Software-hardware Integrated Error Pattern of Software-intensive Systems

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**Abstract**—Orthogonal defect classification (ODC) is a multi-dimensional measurement system with both qualitative and quantitative characteristics. And it is currently widely used in the software industry. However, its high level of abstraction leads to limited semantic information. Therefore, it seems to have a limited role in the process of software engineering of software-intensive systems (SISs). To solve this problem, this paper first analyzes software error lifetime from the perspective of knowledge-based software engineering and proposes an error generation model. Then, the paper proposes the concepts of software error pattern (SEP) and software requirements error pattern (SREP) based on the ODC. Then, according to an error generation mechanism, four types of software-hardware integrated error pattern (SHIEP) in the requirement stage, which is a sub-category of SREP, and corresponding ontology representation are given, focusing on “scenario”, “error manifestation” and “solution”. Finally, this paper takes a certain type of airborne radar software system as an example, uses protégé to edit the SHIEPs and instances, and further introduces the application of software FMEA based on the above work. The results show that the prior information based on the SHIEPs is helpful to discover potential failures and failure modes that may adversely affect the function or performance of SISs. Therefore, the proposed SHIEP is of great significance for improving the quality of software development and verification.

**Keyword**—orthogonal defect classification, ontology, pattern, software error



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