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## 主 論 文 の 要 旨

論文題目      Detecting context-dependent defects and  
measuring review quality for software reviews  
(ソフトウェアレビューにおけるコンテキスト  
依存型欠陥の検出とレビュー品質の測定)

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## 論 文 内 容 の 要 旨

This thesis focuses on two issues preventing software reviews from providing the expected effect. The first issue is low review quality, which results in that software review materials include overlooked defects. The second issue is context-dependent defects, which could not be considered as defects and turn out to be defects in the subsequent software development activities.

For the first issue, this thesis proposes a metric, the number of questions and discussions, which identifies concerns in software reviews. First, I defined an effective question, which identifies concerns. Then, I defined detailed software review processes (identifying, sharing, and recording processes), which capture how concerns identified by effective questions were shared and defects were documented. I conducted a case study with 25 projects in industry to investigate the impact of the number of effective questions, which identified concerns, on the number of detected defects in subsequent testing. The results of a multiple regression analysis showed that the number of effective questions predicted the number of defects in subsequent testing at the significance level of 0.05.

For the second issue (context-dependent issue), this thesis conducted a case study to investigate which type of defects could be regarded as context-dependent defects. Specifically, I analyzed defects that required significant correction effort in a simulation control software system development. The results of the case study showed that the defects were ambiguity defects (context-dependent defects) injected by misunderstandings and inconsistencies among stakeholders during interpreting requirements and specifying design documents. The ambiguities of the specifications are found in the definitions of distance, time (time zone), and calculation accuracy. These cause inconsistencies among the implementations and errors in the control simulation execution results. Based on the analysis, I propose a low-effort defect prevention approach c

learly defining the units to avoid such ambiguities. I evaluated the approach and estimated the expected effort reduction in the target control simulation software system development.

Additionally, this thesis proposes a software review method to detect context-dependent defects by generalizing the ambiguity defects identified in the simulation control software system case study. The proposed method can help reviewers detect omissions or ambiguities in requirements caused by design context. Some software requirements are omitted or ambiguous depending on the design context, although these requirements would not necessarily be regarded as omitted or ambiguous when viewed as requirements alone. The design context sometimes causes inconsistencies among implementations that realize the same requirement. The proposed method defines goal-oriented check items for design review using a goal tree obtained by goal-oriented requirements analysis. Reviewers use the goal-oriented check items to detect inconsistent implementations that realize the same requirement. This thesis also evaluates the proposed method through a case study. The results of the case study showed that the proposed method defined five goal-oriented check items and that reviewers detected 24 context-dependent defects with goal-oriented check items. The results also showed that the sum of the estimated additional effort to define goal-oriented check items and perform design reviews with goal-oriented check items was 19.6 person-hours. Furthermore, the results showed that an engineer with general skills and knowledge of software development but without system-specific skills and knowledge could define a goal tree and the corresponding goal-oriented check items.