

論文 / 著書情報
Article / Book Information

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Title(English)	Algebraic Formalization for Splitting and Merging Coordination in Organization
著者(和文)	菅 哲哉
Author(English)	Tetsuya Suga
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Category(English)	Doctoral Thesis
種別(和文)	論文要旨
Type(English)	Summary

論文要旨

THESIS SUMMARY

専攻: 経営工学 専攻
Department of
学生氏名: 菅 哲哉
Student's Name

申請学位(専攻分野): 博士 (工学)
Academic Degree Requested Doctor of
指導教員(主): 飯島 淳一 教授
Academic Supervisor(main)
指導教員(副):
Academic Supervisor(sub)

要旨(英文 800 語程度)
Thesis Summary (approx.800 English Words)

Reorganizing business processes and organizations is crucial to corporate management. Dividing organizations into units capable of collaboration is often necessitated by changes to a company's internal processes and organization, changes invoked by mergers and acquisitions, and in- or outsourcing. Enterprise engineering, a subdiscipline of industrial engineering and systems engineering, has enabled practitioners to model processes and organizations for managing changes in their processes and assignments of roles and responsibilities more efficiently and effectively using model-based engineering methodology. Over the years, theoretically expected outcomes and benefits have been empirically tested by researchers and practitioners. In enterprise engineering, models are used for improved communication among stakeholders, improved quality through early identification of issues, and reduced risk through early and ongoing validation and verification using computer simulation. This research adopted a modeling methodology called Design & Engineering Methodology for Organizations (DEMO), developed within the field of enterprise ontology, which is one of the three pillars in enterprise engineering. DEMO enables comprehensive and coherent understanding of an enterprise with complexity reduction and explicit design choices through extraction of essential activities in enterprises and modularization of universal patterns in coordination activities surrounding production activity.

As enterprise engineering is model-based, splitting and merging processes and organizations on models means performing model manipulations such as splitting and merging models. Although considerable research has focused on where to split processes and organizations based on evidence such as dependencies and proximities, little attention has been devoted to the execution of model manipulations per se or their characteristics. For instance, does merging model A into model B have a different result from merging B into A? Also, consider the merging of three models, A, B, and C: does merging A into the result of a B-C merge have a different outcome than merging the result of an A-B merge into C? Most previous studies do not take these questions into account. As a result, model manipulations must be executed manually, and the result of a manipulation must be checked by experts.

To solve these two interrelated issues, this research proposed rigorous mathematical model manipulations by defining two major types of diagrams used in DEMO with different

levels of abstraction, Organization Structure Diagram (OCD) and Process Structure Diagram (PSD). Being static over time, OCDs were formalized set-theoretically, meaning the merge manipulation of OCDs and the inclusion relation over OCDs were defined using concepts from set theory. In contrast, as per their dynamic behavior, PSDs were formalized using finite state machines, whereas the merge manipulation of PSDs and inclusion relation over PSDs were defined using the concept of finite state machine composition and the weak simulation relation in theoretical computer science, respectively.

One may raise a concern about the difficulty of learning the proposed method to split and merge processes and organizations using a mathematical approach. The appeal of the proposed method is limited by two obstacles. Mathematical notations often intimidate practitioners, even though they are as easy as those taught in high school math courses, and force attention to mathematical details that do not reflect fundamental tasks in a reorganization. This research solved such a difficulty by implementing interchange between DEMO diagrams and mathematical representations as well as automatic execution of model manipulations, which were performed by hand.

The utility of the proposed method and software implementation was tested under a case study with real-world scale and complexity. The case was created based on processes and organizations in public long-term care insurance in Japan. In the Japanese insurance system, stakeholders include municipalities as the insurers, insured individuals, care planning specialists, and care service providers. Duties involved include the determination of the level of care and support that the insured individual requires, creation of care provision plans by the care planning specialist, provision of care by the service provider, and monetary payments associated therewith. Given the OCD and PSD for the entirety of processes and organizations, it was demonstrated that designers could split the diagrams into parts and merge the parts in an arbitrary way with software support.

The method proposed in this dissertation achieved a significant reduction in manual work during model manipulations and eliminated certain verification steps with future application toward a computer-aided design of processes and organizations in mind. These contributions enabled practitioners without expertise in DEMO to perform mathematically rigorous yet robust model manipulations easily without directly facing mathematical difficulties.

備考：論文要旨は、和文 2000 字と英文 300 語を 1 部ずつ提出するか、もしくは英文 800 語を 1 部提出してください。

Note: Thesis Summary should be submitted in either a copy of 2000 Japanese Characters and 300 Words (English) or 1 copy of 800 Words (English).

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