Preface

With the rise of service-oriented architecture and multi-vendor system integration, computer systems and software have become increasingly complex. This increasing complexity calls for a multi-faceted approach to not only the development process but also the modeling and analytical processes, taking into special consideration the functionalities best suited for the evolving needs of the end-user. *Systems and Software Development, Modeling, and Analysis: New Perspectives and Methodologies* discusses the issues, challenges, and standards associated with systems and software development, the dynamic modeling methods required for successful system analysis and design, and the analytics tools used to identify tendencies and standards that must be considered in order to yield a relevant, high-quality end product.

The book is organized into 11 chapters. A brief description of each of the chapters can be found below:

In chapter 1, “Semantically Integrated Conceptual Modeling Method and Modeling Patterns,” Remigijus Gustas and Prima Gustiene discuss the management of evolutionary changes, identification of discontinuities, and separation of concerns in information system development. The chapter presents one of the fundamental problems faced by information system developers today: that most conventional conceptual modeling techniques deal with the collections of loosely linked meta-models, which are defined by the different types of diagrams. In this chapter, the authors present the semantically integrated conceptual modeling method. They posit that the advantage of this method is stability and flexibility of the diagrams to manage the constant changes of system requirements. Through case study examples, the authors show that sequential, underlying, enclosing, overriding, and overlaying interaction loops between actors provide the foundation for the composition of complex scenarios.

Raymon R. Bruce traces the origin of the concept of work in the second chapter of this book, titled “Founding a Field Theory of Work: Re-Organization through Energy Exchange.” In five sections, the author provides an answer to the question, what is work?, develops the Greek word family for work into a dynamic model of doing, shows how nature guides work change through energy exchange, examines policymaking as human guidance imitating nature, and presents the author’s issue analysis as an invited Organization Development consultant who helps the Sri Lankan government, the University of Moratuwa, and the apparel and textile industry find ways to work together in their extreme makeover of human resource development of their apparel and textile industry. Action training and research, stakeholder management, and wicked problem issue analysis were the organization development methods used to demonstrate this field theory of work re-organization through energy exchange.

In “Context Inference Engine (CiE): Classifying Activity of Context using Minkowski Distance and Standard Deviation-Based Ranks,” the third chapter of this book, Umar Mahmud and Muhammad Younus Javed define context awareness and context-aware systems. They propose a Context Inference Engine (CiE) that classifies the current context as one of several known context activities.
Chapter 4, “Simple System Dynamics and Control System Project Models,” examines the established Systems Dynamics (SD) methods applied to software projects in order to simplify them. A SIMULINK version of an SD model is used in the chapter, and conclusions are made with respect to the initial main controlling factors, compared to a NASA project. Control system methods are used to evaluate the critical features of the SD models.

Nicholas C. Georgantzas and Evangelos Katsamakas present a System Dynamics (SD) simulation model that replicates self-organizing system uncertainty results and looks at self-organization causally in chapter 5, “Modeling a Simple Self-Organizing System.” The authors use SD simulation and model analysis results to show how distributed control leads positive feedback to explosive growth, leaving the system in a stable, negative feedback state. The chapter’s SD model analysis helps explain why phenomena of interest emerge in agent-based models, a topic crucial in understanding and designing Complex Adaptive Self-Organizing Systems (CASOS).

In chapter 6, “The Role of Standards in the Development of New Informational Infrastructure,” Vladislav V. Fomin and Marja Matinmikko inch towards a better understanding of the notion of informational infrastructure and the role of standards in the development of infrastructures in the new information age. Specifically, the authors consider standardization processes as pertaining to informational infrastructure development. They focus on two particular aspects of standardization: temporal dynamics and social organization. Using Bauman’s concept of liquid modernity, they argue that standards often become hybrids of solid and liquid modernities linking together different scales of time, space, and social organization. To better illustrate theoretical concepts, they draw on practical examples from the development of informational standards, infrastructures, and services, particularly from the domain of Cognitive Radio Systems (CRS) with the overall aim of offering scholars of standards and innovation a fresh, non-mainstream perspective on the social and temporal dynamics of standardization and infrastructure development processes.

In chapter 7, José Eduardo Fernandes and Ricardo J. Machado revisit the contributions of Pervasive Information Systems (PIS) researchers to provide a pattern that supports the use of the development framework and profiling approach on software development for PIS. Their chapter, “Development Framework Pattern for Pervasive Information Systems,” completes the first series of research contributions for the development of PIS and presents a case study that demonstrates the applicability of these contributions.

Andreas Barth, Andreas Knobloch, Silke Noack, and Frank Schmidt present five case studies to illustrate the current possibilities and limitations of spatial predictions with the use of artificial neural networks in chapter 8, “Neural Network-Based Spatial Modeling of Natural Phenomena and Events.” Applications presented by the authors are: (1) the prognosis of soil erosion patterns, (2) the country-wide prediction of mineral resources, (3) the vulnerability analysis for forest pests, (4) the spatial distribution of bird species, and (5) the spatial prediction of manganese nodules on the sea bottom.

In chapter 9, titled “Multidimensional Data Analysis Based on Links: Models and Languages,” Paulo Caetano da Silva addresses the need for a solution for OLAP systems in order to assist in the strategic analysis of the organizational data represented in XML format. Aiming at overcoming this issue, the author proposes an analytical system composed by LMDQL (Link-Based Multidimensional Query Language), an analytical query language; XLDM (XLink Data Metamodel), a metamodel given to model cubes of XML documents with XLink and to deal with syntactic, semantic, and structural heterogeneities commonly found in XML documents; and XLPath (XLink Path Language), a navigation language for XML documents connected by XLink. As current W3C query languages for navigating in XML documents do not support XLink, the author also discusses XLPath to provide features for the LMDQL query
processing and a prototype system enabling OLAP queries over XML documents linked by XLink and XML schema. In order to validate the proposed system, a case study and its performance evaluation are presented to analyze the impact of analytical processing over XML/XLink documents.

In “A Scouting-Based Multi-Agent System Model to Deal with Service Collaboration in Cloud Computing,” Mauricio Paletta discusses MAS-Scout, a framework that defines Multi-Agent Systems based on the principles of Scouting. In this chapter, MAS-Scout is used to design a system to deal with service collaboration in a cloud computing environment focusing on the premise that Scouting has been a very successful social movement in the world and that collaboration is part of its principles. The results presented in this chapter show that MAS-Scout, which is based on the Scouting principles can be satisfactorily used to automate cloud computing needs.

The last chapter, “Power Quality Improvement using Improved Approximated Fuzzy Logic Controller for Shunt Active Power Filter,” authored by Asheesh K. Singh and Rambir Singh, presents the design approach of an Improved Approximated Simplest Fuzzy Logic Controller (IASFLC). The chapter authors propose a cascade combination of simplest 4-rule Fuzzy Logic Controller (FLC) and an nth degree polynomial as an IASFLC to approximate the control characteristics of a 49-rule FLC. The proposed IASFLC is used to control the dc link voltage of a 3-phase shunt Active Power Filter (APF). A detailed analysis is performed during transient and steady state conditions to check Power Quality (PQ) and dynamic performance indices under randomly varying balanced and unbalanced loading conditions. The performance of proposed IASFLC is compared with a 49-rule FLC and Approximated Simplest Fuzzy Logic Controller (ASFLC) based on minimization of the deviation at central values of Membership Functions (MFs).

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