INSTITUT FÜR BAUINFORMATIK
PROF. RAIMAR J. SCHERER
JAHRESAUSBLICK

TECHNISCHE UNIVERSITÄT DRESDEN

RESEARCH AND LECTURE ACTIVITIES IN 2007

December 2006

Research at the ”Institute of Construction Informatics – Bauinformatik” (CiB) is in two directions:

Applied Informatics and ***Applied Stochastics***

The view of the brochure is directed to the future, i.e. to new ideas and what is planned to be done by each research assistant and PhD student in 2007, based on the results achieved in 2006. Current research topics are: (1) engineering and business ontologies for distributed information and knowledge management focused on dynamic virtual enterprising and cross-sectoral teams in networked business, exploiting P2P, GRID and agent technology, (2) evolutionary building product and process models, (3) service-oriented architectures for distributed information management, (4) process pattern methods for dynamic business organization of virtual organization implementations, for context-sensitive information management, and for prognosis of earthquake accelerations, (5) networked risk management, (6) data mining in earthquake engineering, and (7) e-Learning. The scope of research is not restricted to the engineering view but captures the related business opportunities, social impact and education as well.

The institute strongly promotes information technology in research and industry. Prof. Scherer is chairman of the European Association of Product and Process Modelling, which organizes its 7th ECPPM conference hosted by CSTB at Nice, France in September 2008. In 2006, the conference brought together leading European academic and industrial researchers and developers in construction IT in Valencia. IAI working groups and members, reporting on progress in IFC developments and several running European R&D projects, took again the opportunity to present their results to a broad international audience (see *http://www.ecppm.org)*.

Know-how transfer to the industry has a high priority for the institute to facilitate practical exploitation of developed innovative IT solutions. For the industry CiB is a National Information Point in construction IT. CiB is active in international and national standardization bodies in the domains of IT-related product, process, and document modelling and holds several chair and vice-chairman positions.

A short retrospect: In 2006, again the “Dresdner Bauinformatik-Gesprächskreis” (Dresden Construction Informatics Dialogue) was organised in March and June (*http://cib.bau.tu-dresden.de/ddbig*) and the next is intended to be held in February 2007.

E-Learning activities have successfully been continued. CiB is developing an innovative interactive distance-learning tool for teaching object-oriented modelling, object-oriented programming and software engineering. The chosen application environment is construction site simulation. The European on-line master course “Information Technology in Construction”, co-ordinated by the University of Maribor, Slovenia, is in its third academic year now and can be chosen at six European universities. At some universities like University College Cork, Ireland these lectures have also been offered in local master programmes since the beginning of the new academic year 2006. CiB’s contributions are lecturing courses in “Data Mining”, “Software Engineering” and “Management Information Systems”.

Collaborative research was reinforced through intensive information exchange with external scientists. In 2006 we were glad to host Prof. Thomas Froese of the University of British Columbia at Vancouver, Canada, Prof. Mohammad Dib Haj Mousa of the Syrian Al Baath University, and Prof. Djordje R. Djordjevic of the Niš University, Serbia. Prof. Scherer was invited as visiting researcher by Prof. Ashak Gupta and Dr. Suresh Bhalla of the Indian Institute of Technology at Delhi, India.

In 2006, three research assistants submitted their PhD theses. Two of them, namely Matthias Weise and Jörg Bretschneider, have already defended theirs successfully, whereas Martin Keller, who left the institute for University College Cork, still waits for his oral defence. In earthquake engineering, the institute has been strengthened by Amin Zahédi, a PhD student from Teheran, Iran, who started work on his thesis in early summer.

Some further information can be found at our web pages *http://cib.bau.tu-dresden.de*

Dresden, in December 2006 Raimar J. Scherer

Institute of Construction Informatics

		Phone extension	Email name
Head of Institute	Prof. Dr.-Ing. Raimar. J. Scherer	3 35 27	Raimar.J.Scherer
Head IT Lab	Doz. Dr.-Ing. Barbara Hauptenbuchner[1]	3 46 41	hb
	Dr.-Ing. Uwe Reuter[2]	3 42 09	Uwe.Reuter
Leading engineer	Dr.-Ing. Peter Katranuschkov	3 22 51	Peter.Katranuschkov
Secretary	Ms Ilona Jantzen	3 29 66	Ilona.Jantzen
Teaching staff	Dipl.-BW Karin Böttcher	3 45 30	Karin.Boettcher
	Dipl.-Ing. Ök. Ingrid Gerk	3 38 23	Ingrid.Gerk
	Dipl.-Ing. Ulf Wagner	3 57 41	Ulf.Wagner
Researchers	Dipl.-Math. Jörg Bretschneider	3 57 44	Joerg.Bretschneider
	Dipl.-Ing. Gerald Faschingbauer	3 42 62	Gerald.Faschingbauer
	Dipl.-Ing. Alexander Gehre	3 57 42	Alexander.Gehre
	Dipl.-Ing. Ulf Wagner	3 57 41	Ulf.Wagner
	Dipl.-Ing. Matthias Weise	3 46 15	Matthias.Weise
PhD students	Jalal Dabagh	3 57 43	Jalal.Dabagh
	Kamil Umut Gökce	3 57 45	Umut.Goekce
	Wael Sharmak	3 97 76	Wael.Sharmak
	Dipl.-Ing. Karin Eisenblätter	3 59 95	Karin.Eisenblaetter
	MSc. Sven-Eric Schapke	3 36 71	Sven.Schapke
	Amin Zahédi Khaméneh	3 57 44	Amin.Khameneh
	Dipl.-Ing. Ronny Windisch	external	Ronny Windisch
	Dipl.-Ing. Steffen Scheler	external	Steffen.Scheler

Phone:	+49 (351) 4 63-{Phone extension}
Fax:	+49 (351) 4 63-3 39 75
Email:	{Email name}@cib.bau.tu-dresden.de {FirstName.FamilyName}@tu-dresden.de
WWW:	http://cib.bau.tu-dresden.de
Regular Mail:	Technische Universität Dresden, Institut für Bauinformatik, 01062 Dresden
Packages:	Technische Universität Dresden, Helmholtzstraße 10, 01069 Dresden
Visitors:	Technische Universität Dresden, Nürnberger Str. 31a, 01187 Dresden

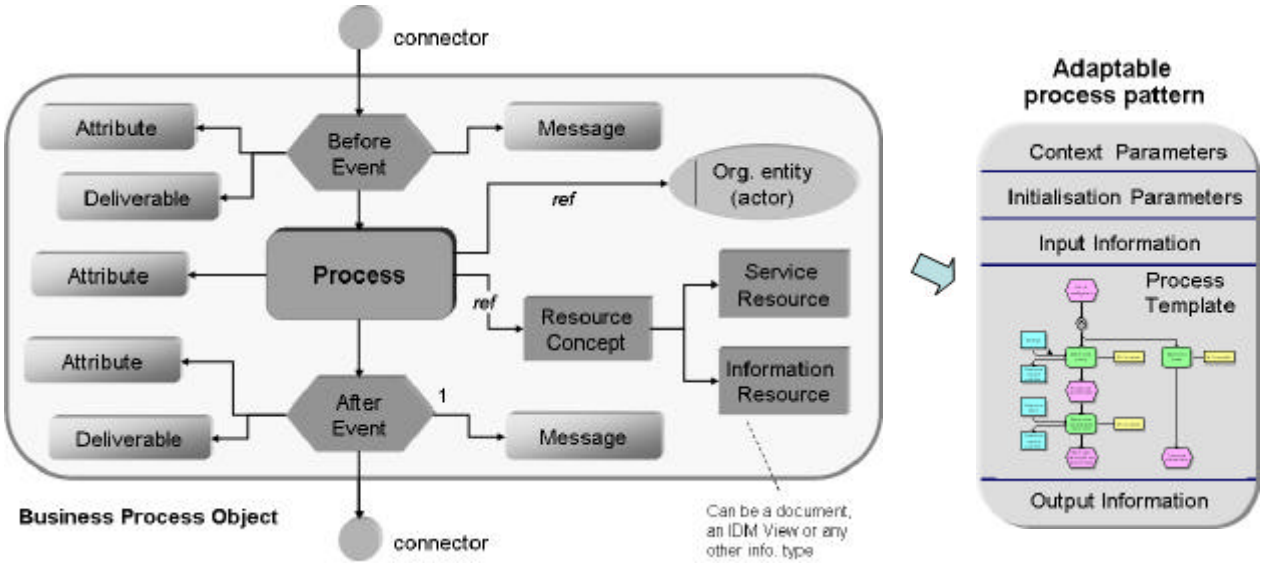
[1)] until 31.03.2007, [2)] from 01.04.2007

Reusable Process Patterns for Collaborative Work Environments in AEC

Peter Katranuschkov

Objectives

For construction and other one-of-a-kind industries like maritime and off-shore achievement of adaptable process-centred collaboration is a topic of utmost importance. This research focuses on the reuse of process knowledge by project teams through conceptual process patterns. The goal is to better support the dynamicity of teamwork and the maltitude of possible unexpected events in the construction value chain to achieve more efficient collaboration within and across the organisations in the one-of-a-kind virtual enterprise performing a construction project. The principal operational objective is the development of an ontology-based framework for modular business process modelling and management that enables flexible integration and adjustment of existing ICT resources and services to the boundary conditions of a specific construction project. A major issue for the achievement of such a framework is to find how to deal coherently with all heterogeneous services and data involved in the project process.



Principal definition of Business Process Objects (left) and their use in the specification of adaptable Process Patterns (right)

Approach

The suggested approach brings together concepts from the ARIS methodology, the Process Matrix specification developed in the EU projects ISTforCE and ICCI and the Web Services Resource Framework (WSRF). Its core is provided by a lean business process ontology establishing a coordinated process-centric view on the overall ICT environment. In this ontology the major concepts "business process object" and the related "business process pattern" are defined. They enable linking together a process and the performing actor, the information resources used/created in the process, the services needed to carry it out, and the required communication with other actors and/or services. Instantiated business process patterns can provide for downstream interoperability and ad-hoc decision making via reference to a set of more specific ontologies regarding the organisational structure of the project, the configured and offered engineering and business ICT services and the involved information resources. Specifically, through the definition of a Resource Ontology based on IFC and IEEE-LOM, a direct interface to IDM Views as developed within the BuildingSMART initiative is established.

Two strategies for dynamic process-centred collaboration are supported: (1) top-down application of process patterns that fit into a high-level process framework, and (2) bottom-up ad-hoc definition of teamwork processes, using and adapting available process patterns as a shopping list. In the first case, global process knowledge is expressed by a Process Module Chain (PMC) while local process data is kept within partial event-driven process chains, observing all specifically assigned authorisation and access rights. The second case acknowledges the lack of a PMC (or even the ability to construct one) in certain situations, as e.g. in early design, or by job site processes that are heavily dependent on external conditions. Here overall performance is achieved by selecting from a library of reference process objects the ones that are most suitable and then adapting, instantiating and optionally interlinking them to a formal workflow.

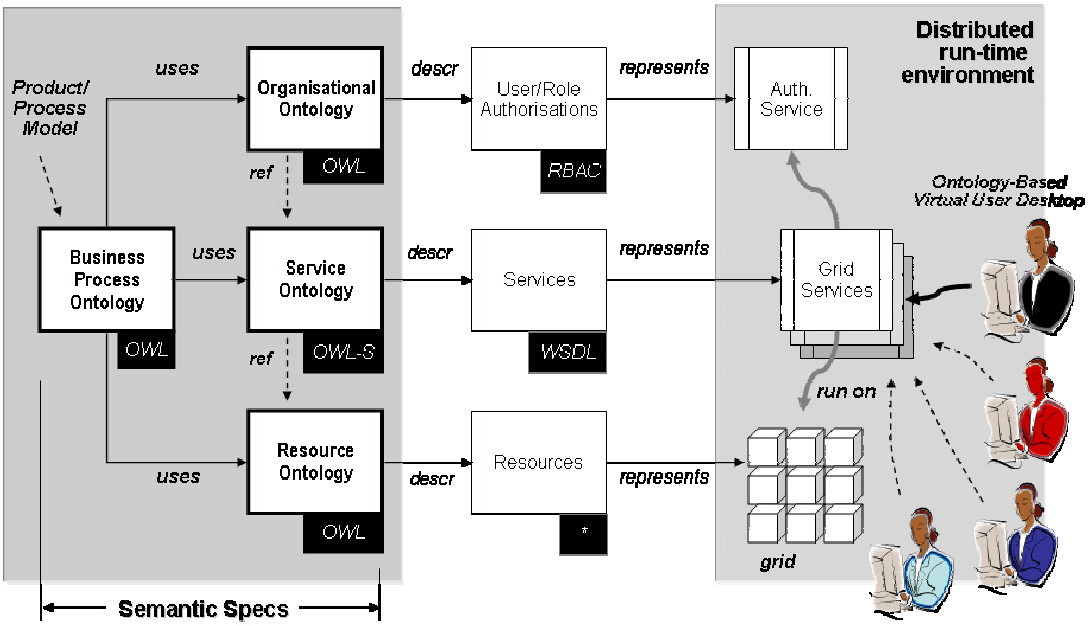
Ontology-Based Business Process Support for VO Grid Environments

Alexander Gehre, Peter Katranuschkov

Objectives

In construction and other similar industries, collaboration denotes an objective that encompasses the idea of interoperability and extends it further to enable cooperative work: (1) between the organisations in a VO performing a construction project, (2) between the divisions of each partnering organisation, (3) in the supply chain, (4) in the knowledge supply chain, and (5) throughout the processes of the project life cycle. Current research work on collaboration is mainly focused on achieving interoperability of model data and application tools, while neglecting their process-related integration. However, efficient dynamic decision making in today's Virtual Organisations (VO) requires interoperable process-centred treatment of all available information and knowledge resources.

The goal of this research is to achieve such an integrated process-centred collaboration support within a heterogeneous distributed VO Grid environment. The technological objective is to develop an ontology framework that (1) enables efficient managing of business processes on the basis of predefined process patterns, (2) provides consistent mapping of the conceptual information layers to technical implementation environments, and (3) supports modularity and extensibility, using as much as possible available standard specifications.



Ontology Framework and grid grounding of ontology entities used in Business Processes Objects

Approach

The essence of the developed Ontology Framework is provided by four independent yet inter-related ontologies that can be further specialised in an extensible set of domain or discipline specific ontologies. These ontologies are organised around the central concept of *Business Process Objects* (BPO).

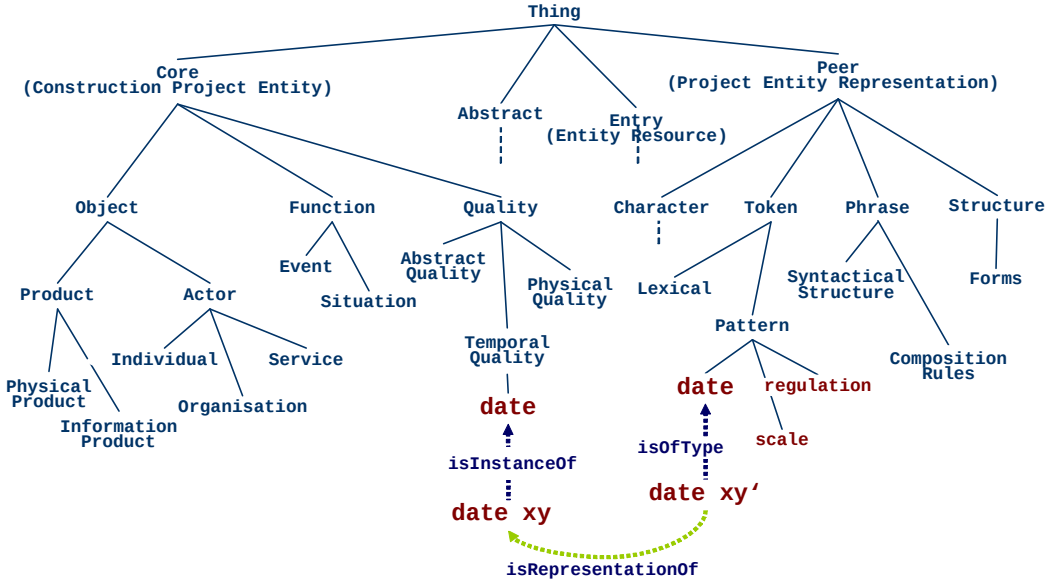
The *Resource Ontology* is dedicated to the representation of all data resources available in the environment (files, documents, product models, product model views etc.). Its domain extensions incorporate ontological representations of domain product data models such as IFC in the AEC domain. The *Service Ontology* formally defines the available grid services using the definitions of the Resource Ontology to specify the content exchanged/provided by the grid services. Domain extension of this ontology is optional and may provide service subclasses that are more tightly bound to respective business requirements. The *Organisational Ontology* defines the concepts of VO actors, VO structure, persons, organisations, roles etc. together with the respective access control and authorisation constraints. It is easily recognisable that the *Business Process Ontology* plays the super ordinate role in the developed framework. It is the ontology which provides an encompassing view on the environment, enables direct relationship to business processes and the related business requirements, and can even be used as basis to support workflow management.

Ontology for Sharing Structured and Unstructured Information Resources in AEC/FM

Sven-Eric Schapke, Peter Katranuschkov

Objectives

Text integration, i.e. the integration of unstructured text information from emails or document files with corresponding structured information e.g. from IFC models, can be considered a two-step analysis task in which text content is first externalised and then interrelated with corresponding structured information. Two semantic web services, namely the 'Semantic Text Annotation and Extraction Service' and the 'Information Resource Sharing and Integration Service' have been introduced to support the two steps in the context of a Semantic Service Environments.However, a central challenge for establishing Semantic Service Environments on AEC/FM projects is the development of a 'shared environment ontology' that considers the aspects of distributed collaborative working as well as the conceptual product and domain views of the different project participants. Moreover, for the envisioned text integration the environment ontology also needs to encompass particular context and general domain knowledge to support the text analysis and be sufficiently flexible to allows for capturing and reconceptualising newly discovered text information.



Upper Taxonomy of the envisaged Construction Information Resources Sharing Ontology

Approach

To support the integrated management and recontextualisation of information from disparate resources a 'Construction Information Resources Sharing Ontology' (CORSO) is developed that particularly addresses the requirements of text integration. Firstly, the ontology must be able to represent multiple and maybe even conflicting occurrences of information within various resources. Secondly, it must provide for a superstructure that is extensible with additional domain-model and linguistic concepts that are relevant for a particular integration task. Thirdly, to cope with the semantic and pragmatic vagueness of natural language text the ontology must provide for storing incomplete text entities while preserving model consistency. To address these requirements, the CORSO ontology follows the design principals of upper ontologies that can be extended most flexibly and provide basic cognitive concepts to classify even insufficiently specified text entities. The superstructure is based on a trichotomy of sub-ontologies distinguishing real-life project entities (Core), their possible representations (Peer), and the resources they originate from (Entry). The Core ontology comprises basic concepts of common product-centred model and process-centred environment ontologies. The Peer ontology captures basic and domain-specific linguistic information such as lexicals and phrase patterns of Core entities. Assertions among linguistic and domain concepts than allow for classifying text entities that are instances of Peer concepts to also be instances of Core concepts, interrelating them to correspondingly structured, e.g. IFC model-based, instances captured in the project ontology.

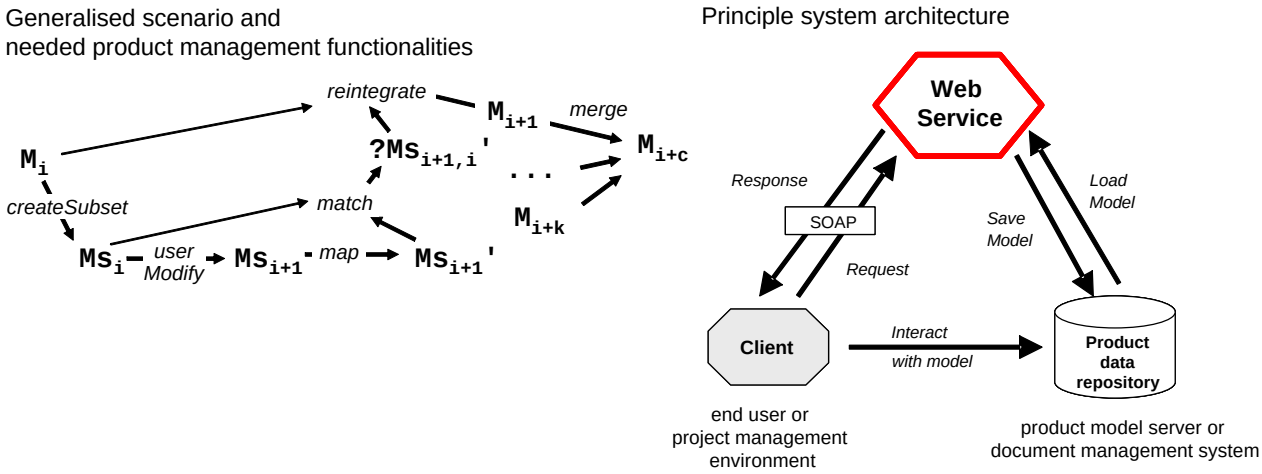
Distributed Product Model Functionality Provided by Web Services

Matthias Weise, Peter Katranuschkov

Objectives

Application of product model technology is a key enabler for data sharing and thus a prerequisite for collaboration. This technology has introduced the product model server as central data repository offering all needed product data management functionality. However, in practice a product model server has to coexist with document-centred project environments leading to additional overhead for administration and synchronization.

The goal of this research is to develop reusable, stand-alone product data management services which can be applied in a web-based IT environment. Instead of dealing with a central product data repository we define a set of basic product data functionalities that can be integrated in existing software environments, as e.g. a document management system, thereby enhancing it to a product and document management server. We focus on a set of basic functions supporting the consistency of the shared model data. They are structured in accordance with a generalised cooperation scenario as shown schematically on the figure below. This scenario comprises the following principal subtasks: (1) check-out, including creation of a model subset M_{si} (typically a domain view) to be used in a specific work task, (2) normalization of the changed model subset M_{si+1} to reduce structural conflicts between M_{si} and M_{si+1} , (3) comparison of M_{si} and M_{si+1} to ascertain the changes done in the user application, (4) check-in to create a new complete data set M_{i+1} , and finally (5) reconciling and merging eventually divergent model states resulting from parallel transactions.



Generalised scenario showing the developed functions to support transaction based cooperation (left) and corresponding principal architecture for their use as web services (right)

Approach

The outlined functions are applicable in more or less the same way in any specific cooperation task and any specific shared product data model used, such as the CIS or the IFC model. Together they provide a well-defined business process that can be generalised in a high-level ontological description of a workflow, encompassing not only the individual subtasks and their pre- and post-conditions but also the involved resources (filtered model views), services and user roles. However, since these functions are interdependent and do all need to interact with a shared model repository, they are realised as stateful services. We suggest an implementation based on the Web Services Technology, being widely accepted and thus supported by a number of development tools. To ensure access to shared data hosted by a document management system, product model server or any other project management environment, we define a generalized resource access service that allows also to store temporary results. The product model services are defined according to their input, output and dependencies. This is done using the Web Service Description Language (WSDL), specifying possible request messages to the web services, the belonging response messages and definitions of required error handling. However, as these services may require advanced user interactions, additional service clients are needed, e.g. to show/compare results or to provide sophisticated partial model selection.

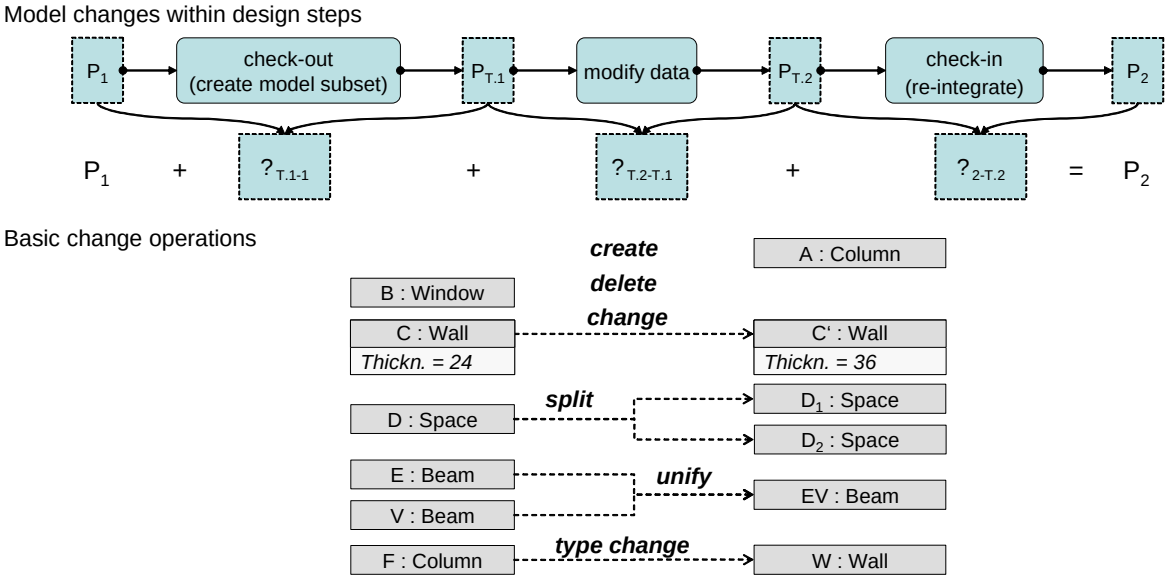
Capturing the Model History to Manage Design Changes

Matthias Weise

Objectives

Change management is a vital constituent of collaborative design work. It provides the basis to coordinate design activities and regain a consistent model state. Other industries like software development or mechanical engineering already use intensively change management methods allowing them to shorten coordination efforts and to improve design quality. The building industry is in demand of similar methods but several constraints have to be considered for their successful application. First, the building industry deals with far less elaborated product design. Second, it is dealing with highly heterogeneous design applications that are far less integrated than needed for seamless data exchange. Third, work is typically performed on design states instead of design changes, which is often imposed by traditional design applications. Therefore, when dealing with up-to-date data sharing concepts such as the BIM approach, change management methods developed by other industries cannot be adapted directly. New ways of working are needed.

The objective of this research is to develop a framework that allows capturing the model history, which is seen as the beginning of change management. We propose to transform design states into design changes. These changes are stored and made available for later reviews. However, as they may also impose changes to the object structure, i.e. objects evolve throughout their life-cycle not only by changing their attributes but also by changing their object type, available version models must be extended, breaking with traditional object-oriented thinking.



Change-based versioning of design states using six basic change types

Approach

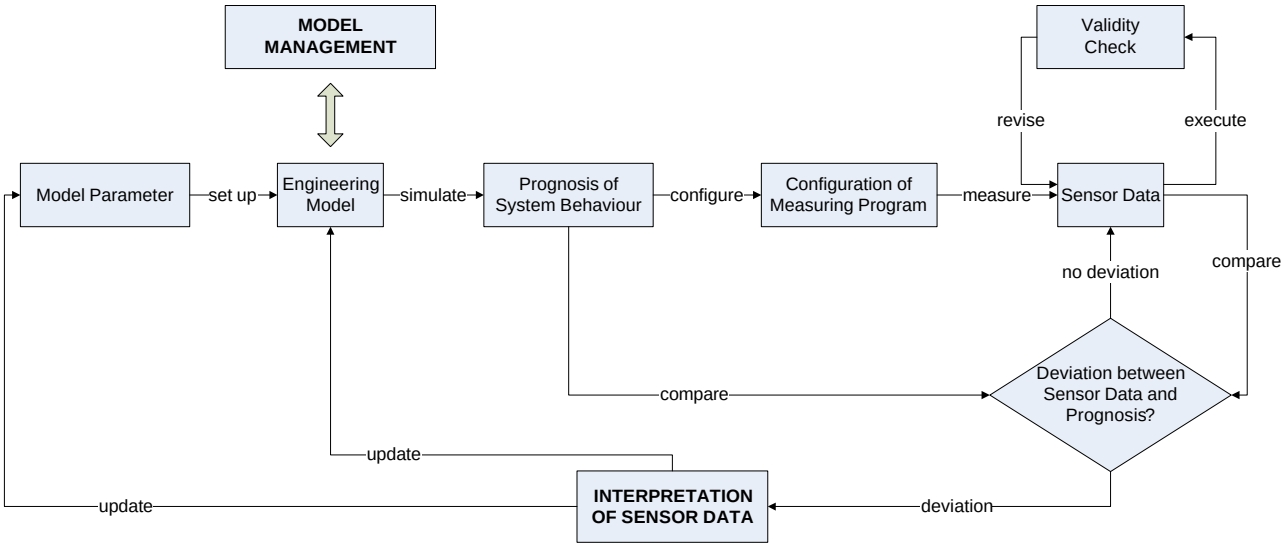
To handle changes to the object structure we introduce three new change operations, namely *type change*, *split* and *unify*. Consequently, beside *create*, *delete* and *change* we are dealing with six basic change operations that enable capturing the model history and handling any object-oriented data structure. The figure above illustrates the overall concept. The set of change operations $\Delta_{2\text{-}1}$ is used to describe the new design state p_2, based on the design state p_1. Thus, it is possible to use the set equation $p_1 + \Delta_{2\text{-}1} = p_2$. This equation can easily be extended to provide more detailed insights into design steps and coordination processes. For instance, it is possible to capture the *check-out* process which creates a partial model $p_{T.1}$ by removing not needed design data. In a similar way, the *check-in* process can be captured, which requires to rebuild the whole model p_2 by using the changed partial model $p_{T.2}$. Consequently, by adding the design changes between $p_{T.1}$ and $p_{T.2}$ the following extended equation is obtained: $p_1 + \Delta_{T.1\text{-}1} + \Delta_{T.2\text{-}T.1} + \Delta_{2\text{-}T.2} = p_2$. This offers a new quality for the reviewing of design steps and enables to easily integrate third party tools supporting collaborative work as well as dealing with model consistency.

Model Management and Interpretation of Measured Data for Monitoring in Geotechnical Engineering

Gerald Faschingbauer

Objectives

The handling of several models and model versions along the whole project cycle, from the setup of the first design, over monitoring and updating of the models during the construction phase up to the conservation of evidence after the end of the project, is an actual problem in geotechnical engineering. The selection of the best model for the simulation of the behaviour of soil out of several possible models is of primary importance and needs the investigation and comparison of these models. The uncertainties of the computations are rather high, due to the heterogeneity of soil and the scattering of subsoil properties. Therefore, the observation of soil behaviour and its changing during construction time as well as its influence on existing buildings near the construction site are of high significance. The principal procedure for this monitoring approach is specified in the observational method after Peck (1969), meanwhile introduced in Eurocode 7. Nevertheless, in practice the application of this observational method is a tiresome, resource-consuming job. The most time consuming part is the investigation and updating of the models according to the measurements. It is a real information management problem. The planned (semi-) automation of the method would greatly facilitate the applicability of the observational method in practice.



Model Management and Data Interpretation in Geotechnical Monitoring

Approach

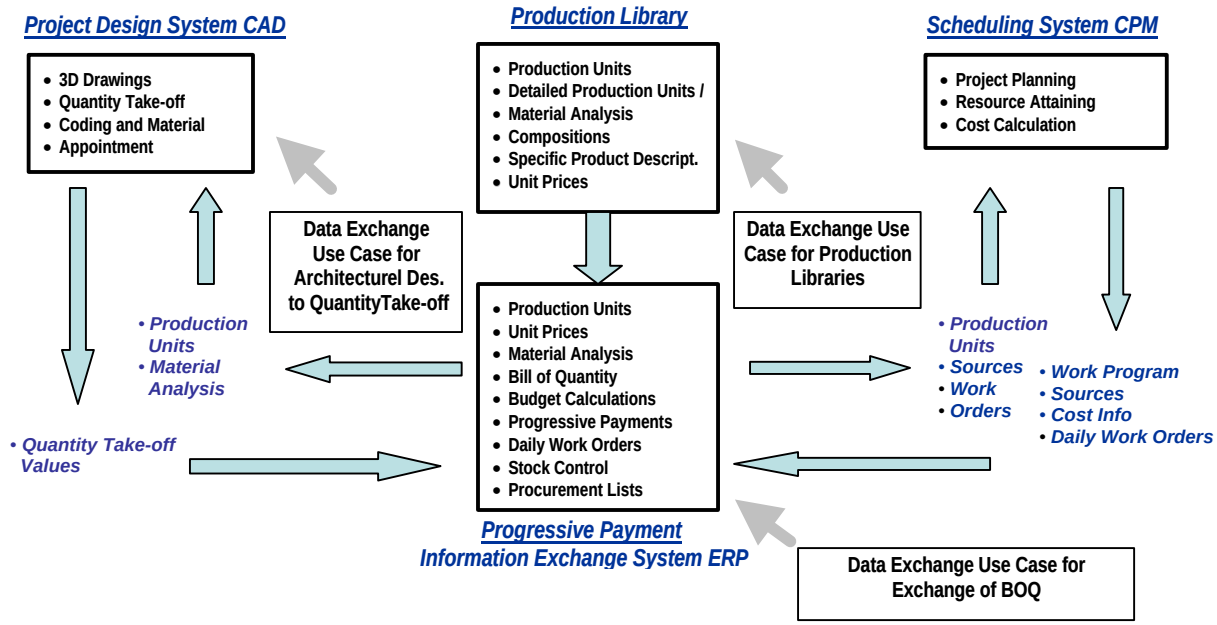
The efficient handling of the problem is based on three essentials: (1) management of the models during the project time, (2) identification of models and model parameters based on the measured data, (3) software integration and involvement of all project partners modifying or accessing the models in a virtual organisation. The focus of our work is on the model management part. In the first step, the actual state of the engineering structures and the subsoil will be made traceable during the whole time. Therefore a model management system will be developed, based on a sustainable, unified, but extendable data model for computed and measured data and also the applied models. This will enforce storage of the models independent of the engineering software applications and therefore the reuse of the models beyond the lifetime of the data formats of the applications. Hence already investigated model versions will be accessible and traceable during the whole time. They can be imported in engineering software tools, modified and saved back to the model management system. Model versions and alternatives can be developed and properly traced. An ontological model of the engineering model assumptions and decisions, i.e. a Meta model, permits the semantic representation of the model and enables the semantic search and reuse of existing models or some of their parts. This approach will enable also the modelling of decision criteria and model assumptions and therefore it will improve the perceivability of the engineering model and of the modelling process. Furthermore, it will also considerably improve the cooperation between the project partners.

IT Supported Construction Project Management Based on IFC and ISO9001:2000

K. Umut Gökçe, Peter Katranuschkov

Objectives

The construction industry is often criticized for being ineffective. Frequently referenced sources of current problems are the weak integration among project partners, the low interoperability of IT tools, the under estimation of quality requirements, and the insufficient consideration of formal management processes. In the last fifteen years, the aim to achieve higher degree of integration in the design and construction process has led to the development of a number of product and process models and integration architectures. However, in spite of all achievements for managing the process, product, documentation and communication, the organisational and information infrastructure in the AEC sector is still highly fragmented. In order to find a solution to these problems, in this research the objectives are formalized as follows: (1) generalize and formally describe CPM processes so that interoperability over a broad spectrum of applications is facilitated, (2) establish a common information model for construction project management based on the data schemas of the IFC standard, and (3) provide interoperability methods to integrate legacy systems.



Definition of subsystems and typical use cases of their interoperable application

Approach

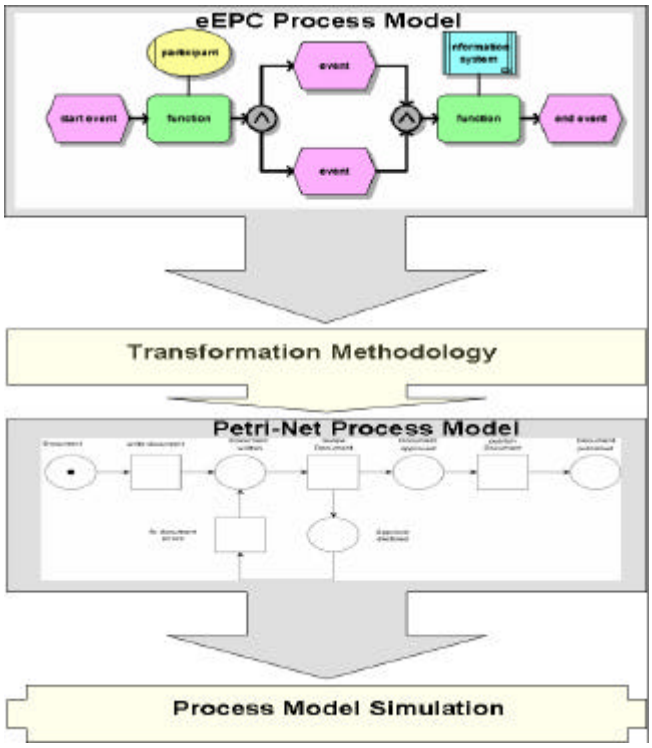
Based on the experience gained from studying state-of-the art systems and best practice examples, construction management phases for software interoperability are formalized using IDEF0 modeling methodology. In order to support organizational management structures and to establish a concurrent control system, ISO9001:2000 Quality Management System Procedures are adopted. In accordance with these, the overall management processes are formalized in two interrelated subsystems using ARIS methodology: (1) Organizational Management Process, and (2) IT Management Processes. The organizational management process is composed of ISO sub-procedures and provides the core process structure from which IT management processes are referenced and coordinated. The IT management processes provide the guiding process structure related to the connection of CAD, ERP and Scheduling systems regarding organizational management work flow functions. Referencing IFC model data will be provided via formally defined IFC views in the context of the respective tasks. This will be achieved with the help of a formal specification using the Generalized Model Subset Definition schema (GMSD) developed at the institute. IFC core schema objects will be used as much as possible, with some needed extensions for project management purposes.

Transferring eEPC into Petri-Nets to Support Processes Simulation

M. Jalal Dabagh

Objectives

The increased use of process modelling in construction has led to increased capabilities of various modelling tools and methods used to support the developed multifaceted process models. This makes it important to be able to choose the best modelling methods and tools to the case at hand in order to achieve an optimal solution for the aimed final process simulation model with consideration of costs, time, and quality. The eEPCs (extended event-driven process chains) provide a common, popular and effective tool for process modelling but not for process simulation. Therefore, models created as eEPCs still need to be simulated using another, more suitable method like Petri-Nets. However, what is still missing is a holistic methodology enabling the transformation of eEPCs into adequate Petri-Net models, taking into account the organisational and information aspects involved. Finding an efficient transformation mechanism is the main objective of this work. Methods to covert normal EPCs to Petri-Nets without considering the organisational and data elements already exist, but solutions for eEPCs are still sought.



Model simulation steps

Approach

Achieving the transformation of eEPCs to Petri-Nets will be done by using complex Petri-nets, i.e. predicate-transition nets or coloured Petri-Nets. The ability of different tokens to represent these additional elements of the eEPC models will be investigated and evaluated.

As a first step, the main EPC will be transferred into a simple Petri-net without tokens. Secondly, the additional elements will be allocated in groups according to their kinds, and suitable tokens and colours for these groups will be chosen. After that, these tokens will be added to the defined simple Petri-Net in their suitable places. In this way, a Petri-Nets model will be obtained which should fully represent the eEPC model. This principal methodology will be applied on different types of eEPC models to check its validity and its generic capabilities.

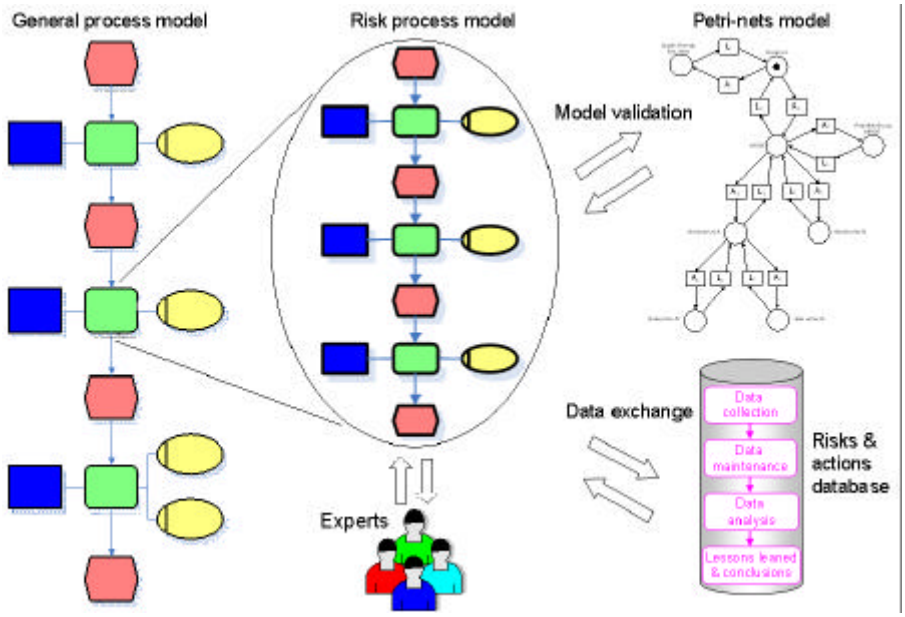
The last step of the work will be the automation of the developed methodology starting with the eEPC model as input and ending with a correct Petri-Nets model as output of the designed software prototype. The developed tool will be integrated as basic component of other related work such as e.g. the knowledge-based risk management process model.

Integrating a Knowledge-Based Risk Management Process Submodel within the General Construction Project Process Model

Wael Sharmak

Objectives

The general objective of this research is to design a holistic risk management process model that supports all construction project phases and provides for solving major difficulties faced by current risk management (RM). This includes: (1) the formalisation of the RM subprocesses and the interrelations among them, (2) the definition of the complex relationships between these subprocesses and the internal and external influences of the project, and (3) the dynamic features of the related construction processes which may require multi-feedbacks to make process-related knowledge up-to-date. The RM model should build upon a generic shared risk database that represents the vital interfaces among the project parties and contains up-to-date information about the risks and measures documented in prior projects, during brainstorming sessions or obtained by expert judgment. Furthermore, as risk is essentially an abnormal event which may occur or not within the normal workflow of the project process, the designed RM model should be considered as a submodel within the general project process model. According to this, an important operational objective of the work is to find how to enable integration of the RM processes within each and every function in the general project process model.



Design environment of the risk management process model

Approach

The phased risk management process is represented using the eEPC method (extended event driven process chain). In the further development work, at first the general organisational structure of a construction project and the participating firms will be described, and the function tree of the risk management process will be designed. Secondly, the developed function tree and organisational structure will be merged with the needed data elements to represent the final risk eEPC. In parallel, the ability of the eEPC to represent the full features of the risk process will be checked, and if not feasible, solutions extending the eEPC or using another process modelling method will be investigated. For verification and feedback, the designed model will be offered to experts in the field of risk management. Thirdly, theRM process model will be validated and simulated using Petri-nets that will allow checking if there are any problems in the designed work flow and making the required modifications to the model's control flow accordingly. All needed or available risk and measures data will be structured in a web-based database that is reachable, reusable and editable by all authorized users involved in managing the project risks. The database will be built in such a way that integration with the aimed RM model can be easily achieved. The above figure shows schematically the envisaged environment architecture and the principal interactions between the components.

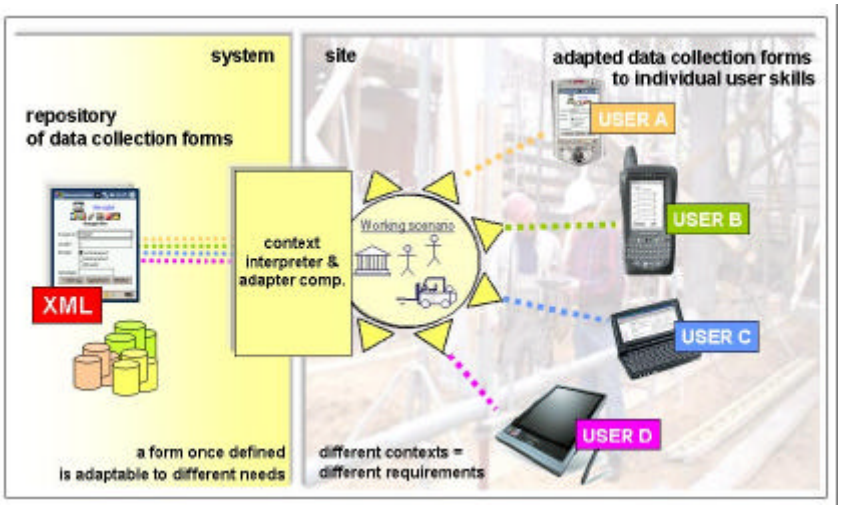
Individualised Context-Sensitive Data Collection Forms for Mobile On-Site Use

Karin Eisenblätter

Objectives

This research aims at increasing the effectiveness and efficiency of documentation and controlling processes of construction projects by providing field workers with more intelligent mobile applications. Basically, mobile applications are used ad-hoc, while standing and paying attention to the primary task in a weather-exposed site. Technical restrictions of mobile devices, e.g. small display, cumbersome interaction facilities etc. impose further constraints on user interaction. Therefore, user interaction has to be made efficient, intuitive and robust in regard to the context. Mobile applications should consider and adapt to context, so that to allow the user to easily access context-relevant information from anywhere and at anytime.

The overall research objective is to set up a framework for context-aware mobile applications that support documentation and controlling processes in the AEC sector. This framework should provide methods for understanding and formalizing context, for identifying adaptation needs, and for implementing context-aware mobile user interfaces and their underlying intelligent services. The current specific operational objective is the development of concepts enabling (1) to describe electronic data collection forms in a flexible, comprehensive way, and (2) to define rules to customize these forms, according to the user's preferred level of detail (determined by the user's context). The result will be more versatile and easier to use electronic forms than currently available.



On the user's request the system's context component generates a form, which is specifically fitting the user's context from a repository of flexible described forms

Approach

Context-adaptivity is a key success factor for mobile and ubiquitous computing applications. However, due to different actor roles, experiences, qualification profiles, mode of operation etc. mobile applications and data collection forms can be looked at from different points of view. A less experienced construction site manager might wish to have a stronger orientation, guidance and technical support on how to fill in data correctly into a data collection form, e.g. for errors and omission management, than a more experienced one. To tackle that major issue, the core concept of *adaptation paths* is proposed. An adaptation path corresponds to the requirements of one point of view for the particular object or object group it is attached to. The path contains nodes which describe the different available levels of detail. Adaptation paths are user-dependent, and therefore specified by the users via a dedicated Meta-model. To attach the paths with a particular form object, the data collection form is explicitly described using a XML-Schema, thereby allowing for modifications in the data collection forms and user interactions during usage. Adaptation of the data collection form is applied to layout, structure and content separately. By using XML-based publishing technologies, such as the XSQL Pages Publishing Framework, XML-trees containing structure, contents and layout of the forms can be derived from database queries on user request and published according to the transformation rules, whose parameters are set according to the current state in the adaptation path.

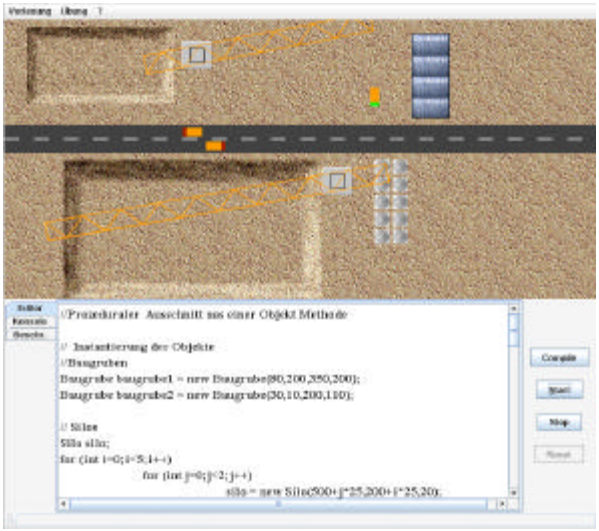
Web-Based Interactive Simulation Tool for e-Learning of Object-Oriented Modelling

Ulf Wagner

Objectives

Engineering students should learn methods and procedures for object-oriented modelling and programming and should understand and learn how to extend existing programs and object-oriented model structures. The handling of software libraries should be learned on the basis of predefined libraries e.g. for construction site elements like containers, cranes, stockyards, temporary buildings, etc. Furthermore, for easier introduction into object-oriented modelling, small dedicated models are necessary, with clear outline of the provided contents. The IFC model used in construction practice leads to elaborate and complex data structures that are less suitable for learning purposes.

Our aim is to design an interactive tool for construction site simulation in JAVA, using an integrated object model consisting of elements and structures for construction sites as an IFC model adaptation that is much easier to understand and handle. It should be readily extensible and the object-oriented structure should be represented in EXPRESS. The model has to satisfy the following requirements: (1) it should contain all basic elements of a construction site, (2) it should be compliant to IFC, (3) it should have a much simpler data structure than IFC, and (4) it should be formally defined in EXPRESS. To provide access both to direct and to distance-learning students the tool should be designed as an e-Learning service, so that students can educate themselves at any time and every place where a web browser is available.



Interactive Teaching Environment for Object-Oriented Modelling

Approach

A concise extensible object model is designed dedicated for engineering education. It is integrated in a web based interactive simulation tool, which will be used for conveyance of teaching contents and as teaching example.

The implementation of the tool is in the form of a Java Applet, to make it applicable via a common web browser on the Internet. The applet consists of two main parts: (1) a graphical presentation panel of the construction site simulation, enabling to see immediately the result of any programming change, and (2) an editor, where context-focused Java code for simulation control can be inserted. The learning modules are read from a SQL database, which is accessible via Enterprise Java Beans (EJB). This makes it possible to insert easily new modules, thereby extending the learning contents. The encoded Java code in the editor is compiled by a compiling web service. The code is sent via SOAP to the web service and the resulting compiled class(es) are dynamically loaded into the applet and executed by pressing a “Start” button.

Through the editor panel the users can interact with the construction site simulation, and simulation activities can be directly shown in the graphical presentation panel. Thus, a clear association between user actions and system reactions is made visible. All available objects are described via the Java-Doc utility and these descriptions are also available on the Internet. The e-Learning environment may be further stepwise extended to an interactive service for professional simulation tools.

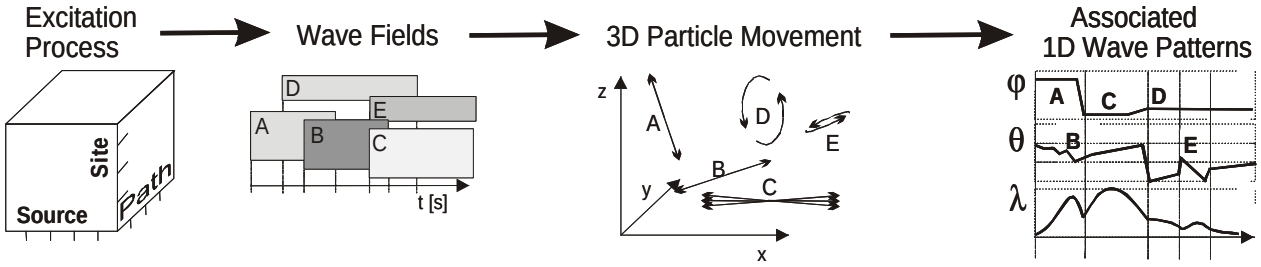
Identification of Wave Train Patterns in Strong Motion Records Using Time-Dependent Principal Component Correlation Axes

Jörg Bretschneider

Objectives

Adequate stochastic modelling of seismic load upon structures should follow a non-stationary approach. Especially, it should focus on wave trains rather than on entire records which leads to levelling of important load features as in current design codes. This alternative approach requires identification of relevant wave trains in recorded 3D strong motion records. These wave trains are of particular wave type and occur in natural sequences, but they strongly overlap in the spatial as well as in the time domain, making their identification and demarcation a difficult task. However, specific axial and planar particle dynamics of the wave types lead to a stable state or trend of the principal direction of acceleration for each wave train, generating certain variable patterns in the course of the 3D principal direction of acceleration. Duration of these states, amplitude and spectral form are influenced by the rupture process, upper crust structure and local site effects.

The focus of research is to find patterns which clearly identify wave trains that are significant for the load process, and to analyse and model these wave fields separately as non-stationary load modules. Especially fast single-record indicators for surface waves are sought, as these waves may carry heavy risk for buildings, as demonstrated e.g. by the 1985 Michoacan Earthquake which devastated central Mexico City. Surface waves usually do not jut out by strong amplitudes, but have long duration and a narrow spectrum in the response range, particularly by pre-damaged buildings. They are seldom identified in strong motion records and are mostly neglected in current design regulations.



From excitation process to 1D wave patterns in the principal stochastic axis

Approach

Characteristic particle dynamics of the wave's type is used to separate the wave trains and to receive clear and stable patterns. Principal axes of time-dependent component correlation, shortly named stochastic principal axes, can be used to track up to three wave trains – dominant, subdominant and weakly dominant – within any local time domain. The figure above displays a typical diagram of the dominant principal axis in spherical coordinates (two angles f , ? and the Eigenvalue ?), revealing characteristic wave-related patterns. In order to interpret these patterns, a comparative model of the excitation process and the local site is to be set up. Starting with a simple model, consisting of a unidirectional one-phased rupture with direct waves and normal site amplification, the model will be stepwise refined and extended to fit with more complicated patterns. Each excitation model leads to model wave trains, for which related formal patterns of the principal axis are formulated in a general way using parametric shape functions, whereby associations in patterns of corresponding indicators are significant. These shape functions will be fit to empirical principal axes data in an iterative process, introducing more complex rupture, regional and local wave generating features in the ground to the excitation model until sufficiently good agreement is attained, measured by an error function formulated on the basis of seismological and structural engineering considerations, e.g. load relevance terms. Datasets of several strong earthquakes with different rupture mechanics will be investigated in the scope of the research work.

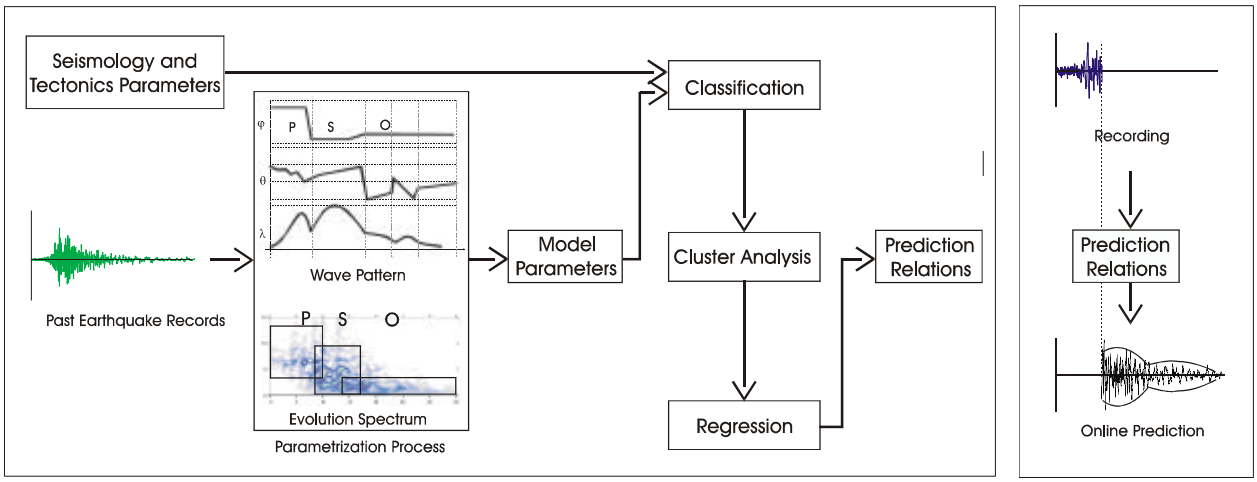
Seismic Wave Based Real-Time Strong Motion Prediction for Active Control

Amin Zahédi Khaméneh, Jörg Bretschneider

Objectives

Structural control is an attractive solution to improve the performance of a variety of structures. For an adequate control of the actuator, a precise real-time prediction of the dynamic characteristics of incoming earthquake waves is necessary. In current methods for real-time earthquake prediction, fundamental characteristics of the loading process are neglected, leading to inadequate predictions.

The objective of this research is to improve the current strongly simplified prediction by taking into account wave regime characteristics and hence include principal non-stationary and site specific characteristics of the loading process. This spatial process consists of different transient wave fields (P, S, Coda and surface waves), leading to strong changes that are unpredictable by usual trend estimates. Load is also strongly but characteristically modified by soil and topographic site conditions. We will develop adaptive prognosis relations to reliably predict frequency, amplitude and dynamic envelopes of P, S and Coda wave fields based upon evolving parts of the P-wave field at the time of the measurement and updated continuously during S and Coda recording.



Development of predictive relations (left) and prediction application (right)

Approach

The sought prediction relations are the result of a multi-level analysis process which combines wave regime characteristics, local site information and global tectonic and seismic settings. The analysis system consists of several steps derived from an evolutionary stochastic model represented in the stochastic Eigenspace. First, a suitable data set of records is classified according to local geotechnical features and seismological parameters of the source. Second, different wave fields are identified from the records by spatial-temporal patterns in the course of time-dependent principal axes estimation of component correlation. These wave fields occur in a well-defined sequence that does almost not depend on the earthquake characteristics and site conditions. The patterns are identified by 1D projections of the actual three-dimensional main principal axis, which is assigned to the main portion of energy both in local and global sense. Third, the load characteristics of each wave field are analyzed by an evolutionary parametric model in the time and frequency domain, leading to the important load parameters. Forth, the data set is classified according to clusters of these load parameters and similar patterns. A correlation analysis will be done to find corresponding classes for each wave field. Fifth, amongst the found corresponding classes, relations between the load parameters of each wave field will be identified by regression analysis, leading to predictive relationships for load parameters established for certain rupture scenarios and site conditions. These prediction relationships will be verified (a) by comparison with records from a validation subset of the database and (b) by comparison with existing real-time predictors.

Research Contracts

Title:	**InteliGrid – Interoperability of Virtual Organisations on Complex Semantic Grid**
Financial Support:	EU, IST-2004-004664, **inteliGrid**
Person Years:	30 (total), 5.3 (CIB, TU Dresden), Duration 2.5 years
Approach:	InteliGrid is extending the semantic grid paradigm to support dynamic virtual organisations (VO) that collaborate on the design, production and maintenance of products that are described in complex, structured, product model databases. The hypothesis of the project is that the collaboration platform - the semantic grid itself - must be aware of the business concepts (e.g. car, plane, house) that the VO is addressing. The grid itself needs to commit to the product and process ontology thereby evolving into an ontology-committed semantic grid. The goal of this project is to create an architecture and a prototype for such an infrastructure, based on existing grid middleware and test it in the context of industries mentioned above. The main results are the generic business-object-aware extensions to grid middleware, implemented in a way that would allow grids to commit to an arbitrary ontology. These extensions are propagated to toolkits that allow hardware and software to be integrated into the grid. Year 2007 marks the last phase of the project where Business Process Object integration and VO collaboration tools will be fully implemented and shown at a workshop to a broad audience from research and industry.
Partners:	University Ljubljana (Slovenia), VTT Technical Research Centre of Finland, ESoCe Net (Italy), Poznan Supercomputing and Networking Centre (Poland), Obermeyer Planen + Beraten (Germany), Conject AG (Germany), SOFiSTiK Hellas (Greece), EPM Technology (Norway). Project support by an international Industry Advisory Board (IAB).

Title:	**Produktdatenmanagementdienste in verteilten Umgebungen für das kooperative Planen** *(Product Data Management Services in Distributed Cooperative Design Environments)*
Financial Support:	DFG (German research foundation), Sche223/36-1
Person Years:	2, Duration: 2 years
Approach:	With the success of product data models such as IFC the paradigm shift from pure document-based work towards a more flexible, dual product and document based cooperation is approaching fruition. The objective of the project is to develop new methods and tools enabling the practice-relevant coexistence and the needed interoperability of unstructured, descriptive construction document and structured product data on the basis of the Service Oriented Paradigm (SOA). Generic product data management methods for model mapping, matching, re-integration and versioning, initially developed in an earlier DFG-Project (Sche 223-27/3 within SPP 1103), will be further extended, adapted to practical use cases, implemented as self-contained Web Services and integrated in a distributed environment with a proprietary file-based information management project portal. This will enable the interoperable, use of (1) various existing administrative portal services, such as organisation and user management, document management, notification/messaging etc. and (2) the set of innovative product data management services within a coherent environment, without the need to maintain a separately managed Product Model Server. A specific research focus of the project lies on the development of product data management methods for long engineering transactions without data locks. These methods will be implemented in scalable robust algorithms, adapted to the IFC Project Model and deployed as dedicated Web Services within the overall production environment.
Partners:	Conject AG (München), Obermeyer Planen+Beraten (München).

Title:	**BauVOGrid – Grid-basierte Plattform für die Virtuelle Organisation im Bauwesen** *(BauVOGrid – a Grid-based platform for virtual organisations in construction)*
Financial Support:	BMBF (German ministry of education and research)
Person Years:	21.2 (total), 6 (CIB, TU Dresden), Duration: 3 years
Approach:	The major objective of the BauVOGrid project is to contribute to the improvement of VO structuring and operability through an innovative Grid-based VO environment that builds upon developments within the German D-Grid initiative as well as prior work of several project partners in earlier or running EU projects such as InteliGrid, K-Wf Grid , AKOGRIMO etc. Main motivation is the fact that because in German construction practice VOs typically include dozens of subcontractors and are characterised by highly complex partner interrelationships distribution of work and responsibilities are intransparent and error-prone, often leading to considerable time and cost loss. A Grid-based platform is going to be developed that enables (1) the formal computer-interpretable representation of authorisation, access control and responsibility structures, (2) the configuration, instantiation and management of both global VO-processes and local partner-internal activities, as well as ad-hoc changes in the project workflow, and (3) flexible access to all kinds of information services both in the office and mobile, at the construction site. The envisaged infrastructure will be achieved by innovative integration of four cutting-edge information technologies, i.e. (1) Grid, (2) Semantic Web, (3) Process modelling and management based on object-oriented eEPCs, and (4) mobile gird-based information and workflow management. R&D work is expected to start in February 2007.
Partners:	Fraunhofer-Institut für Rechnerarchitektur und Softwaretechnik (Berlin), Institut für Wirtschaftsinformatik im DFKI (Saarbrücken), IDS Scheer AG (Saarbrücken), conject AG (München), Bilfinger Berger AG (Mannheim), Müller-Altvatter Bauunternehmung GmbH & Co. KG, Niederlassung Dresden, RIB Information Technologies AG (Stuttgart), Bundesverband Bausoftware e.V.

Lecture Activities 2007

In the new curriculum, starting with the academic year 2006 on 1 October 2006, the students can now choose construction informatics as a competence feature in their studies. This means that in the 3-semester Diploma course, starting with two preparatory lectures two semesters before, students can chose construction informatics as a second subject. As the main subject, Diploma courses are offered for (1) structural engineering, (2) construction management, (3) urban engineering, infrastructure and transportation engineering, (4) hydraulic and environmental engineering and (5) computational engineering. Studies in the Diploma course are organized in modules of 6 hours a week yielding in 5 credit points. The 3 semesters include a project work in the 3rd semester and the Diploma thesis. Both can be done in construction informatics. As construction informatics has to be a complementary subject a pool of 5 modules is offered to the students in order to allow them complementing their basic studies in an optimal and individual way. One of the 5 modules is mandatory, namely WP3-13 "Construction Informatics – Fundamentals", whereas the other two can be chosen out off the remaining four (WP4-XX). Each of the 4 modules is preferably aligned to one of the Diploma courses, which is indicated by intended audience of the course.

Structogram on construction informatics in the civil engineering curriculum

G7 *obligatory*	1st + 2nd semester
GF9 *obligatory*	5th + 6th semester

Diploma/Master courses, if construction informatics competence is chosen

structural engineering	construction management	urban and infrastructure engineering	hydraulic and environmental engineering	computational engineering	
WP3-13 *obligatory*	**WP3-13** *obligatory*	**WP3-13** *obligatory*	**WP3-13** *obligatory*	**WP3-13** *obligatory*	5th +6th semester
WP4-22 *suggested*	**WP4-33** *suggested*	**WP4-60** *suggested*	**WP4-60** *suggested*	**WP4-69** *suggested*	7th+8th semester
select any	*select any*	*select any*	*select any*	**WP4-70**	7th+8th semester

Module G7: Construction Informatics Fundamentals

Intended Audience: Main courses of civil engineering (1st and 2nd semester)
Duration: 2 semesters
Lectures and Tutorials: Scherer/Wagner

Subjects: This module, comprising two courses, provides basic knowledge about algorithms and data structures as well as their modular implementation in an integrated software system. The relational and the object-oriented modelling and programming approaches and the definition and generation of specific views (such as geometrical, topological and graphical representations) are explained on the basis of real AEC objects. The students obtain the ability to think 'object-oriented' in order to structure complex problems modularly and develop generalised modular solutions using algorithms and data structures adequately, with due consideration of their dual and complementary nature. They acquire the capability to formally specify and perform selective, focused modifications as well as further extensions to existing software systems using available software libraries. The module is configured as an e-learning module with object-oriented e-learning tools.

Module GF9: Information Management and Numerical Mathematics

Intended Audience:	Main courses of civil engineering (5th and 6th semester)
Duration:	2 semesters
Lectures and Tutorials:	Scherer/Hauptenbuchner

Subjects: The two courses of this module enable the acquisition of knowledge about the basic methods and procedures from the domains of numerical mathematics and information management that are used for the solution of engineering and economic problems in AEC. The students obtain knowledge about principal solution algorithms for linear equation systems and skills in the handling of matrix methods as well as approximation and interpolation techniques, especially using Spline Methods. They learn the fundamentals of Building Product Models and their object-oriented representation which is especially useful for tackling the complexity and heterogeneity of the information resources in construction, the resulting distributed modular data structuring and the related interoperability methods. Basic techniques for the structuring and the formalisation of complex engineering information are presented that empower the students to handle the complex information used in AEC software in such way that it can be efficiently communicated within cooperative design and project management processes.

Module WP3-13: Construction Informatics – Advanced Fundamentals

Intended Audience:	All master courses in civil engineering (selectable obligatory module) Obligatory module for the master courses in Computational Engineering
Duration:	2 semesters (from 5th semester up)
Lectures and Tutorials:	Scherer/Katranuschkov

Subjects: The module comprises courses on the topics ‘System Theory and Logic’ and ‘Graph Theory’. It introduces the fundamental principles of Mathematical Logic and provides an overview of the basic rules of 1st and 2nd Order Predicate Logic thereby enabling the acquisition of basic knowledge in conceptual modelling, logical reasoning and consistency checking of complex systems. The fundamentals of Relational Algebra are presented and on that basis the classification of Graphs (as e.g. simple, bipartite, multi- and hyper-graphs) together with their specific properties are explained. Furthermore, the fundamentals of graph based Network Planning are presented including topics like 'paths in networks', ‘path algebra', 'flows in networks' etc. Basic knowledge about Petri Nets is also provided to enable the students to (1) develop, (2) formally describe and (3) check in terms of consistency various functions of static and dynamic systems such as the force flows in structural systems, the transportation flow (logistics) in urban planning and construction project management and the overall information and work flows in construction projects (information logistics). The students acquire relevant system-theoretical knowledge and learn composition and representation methods that will enable them to distinguish between various formalisation possibilities such as state-space-based, event-based or activity-based modelling.

Module WP4-22: Cooperative Design Work and Numerical Methods

Intended Audience:	Master program in structural and computational engineering (selectable obligatory module)
Duration:	2 semesters (from 7th semester up)
Lectures and Tutorials:	Scherer/Katranuschkov

Subject: This module comprises two courses on the topics ‘Numerical Engineering Methods and Visualisation’ and Methods for Collaborative Work’. The first course imparts basic knowledge about the numerical algorithms for (1) function approximation, differentiation and integration, (2) the solution of non-linear systems of equations, (3) boundary problems in ordinary differential equations of first and higher order, (4) partial differential equations and (5) eigenvalue problems, as well as knowledge about the stability and decidedness of numerical solutions. It provides also principal knowledge about the visualisation of multidimensional variables thereby generating skills to use

graphical methods for the visualisation of engineering values and entities in goal-oriented manner, in order to correctly determine system behaviour. The second course imparts basic knowledge with regard to (1) distributed information management with long engineering transactions, (2) cooperative work methods, (3) workflow methods and (4) data security. On the basis of this module the mathematical and information technology prerequisites for efficient practicing of networked cooperative design work are acquired.

Module WP4-33: Software Systems

Intended Audience:	Master program in construction management (selectable oblig. module)
Duration:	2 semesters (from 7th semester up)
Lectures and Tutorials:	Scherer/Katranuschkov

Subjects: The module comprises courses on the topics 'System Development' and 'System Integration'. It imparts capabilities (1) to conceptualise an integrated information system that satisfies the requirements of a construction project, and (2) to use efficiently proprietary software programmes applying as much as possible commonly known, typical tools and standardised data structures. The focus of the acquired knowledge is on practice relevant methods of system development, database design, structuring and application, and the conceptualisation of appropriate interfaces. The knowledge acquired in the area of System Development, includes the preparation and use of requirements analyses, the formalisation of the information process and the information flows, the development of system architectures and of meta data structures, and the definition of programming specifications. The knowledge acquired in the area of System Integration addresses the capabilities to develop the structure of a database using a typical database management system (DBMS), create the database itself using standard software tools, conceptualise appropriate interfaces, and integrate data converter, filter and external web-based services.

Module WP4-69: Simulation and Monitoring of Engineering Systems

Intended Audience:	Master program in hydraulic and environmental engineering (selectable obligatory module)
Duration:	2 semesters (from 7th semester up)
Lectures and Tutorials:	Scherer/Hauptenbuchner/Faschingbauer

Subjects: This module comprises courses on the topics 'System Simulation' and 'Data and Information Analysis'. It enables the acquisition of skills for multidisciplinary conceptualisation, control and monitoring of dynamic processes in engineering systems, as well as for their modelling and simulation and the definition of appropriate interfaces for their modularisation. The students acquire the necessary knowledge about numerical and computational methods for the simulation of dynamic systems and about various approaches for the application of distributed computing. Furthermore, they acquires knowledge of the basic methods for data analysis and data reduction as well as Fourier, principal axis and wavelet analysis. The module imparts fundamental knowledge on Information and Data Mining Methods that will enable the students to correctly interpret the behaviour of an engineering system in order to identify damage and complex damage inter-relationships, system malfunctioning and system gaps, and establish appropriate risk management procedures.

Module WP4-70: Model-Based Working

Intended Audience:	Master program in construction management (selectable oblig. module)
Duration:	2 semesters (from 7th semester up)
Lectures and Tutorials:	Scherer/Katranuschkov

Subject: Through the two courses of this module the students acquire capabilities to structure and formalise complex construction projects in order to handle their information logistics and internal relationships efficiently. This enables them to design an appropriate organisational and processing

structure, determine the respective information management methods and procedures and develop appropriate risk management plans. The module imparts knowledge about (1) contemporary modelling methods, (2) object-oriented data structures and the conceptualisation of meta schemas and hierarchical schemas, and (3) interoperability approaches based on methods for model mapping, matching and merging. In the first course detailed knowledge is provided with regard to methods for formal object-oriented system description, the formation of subsystems and consistency checking, and their realisation on the basis of numerical and logical algorithms. In the second course detailed knowledge is provided about the modelling of project processes and process flows, including the complementary information processes and their formal representation.

Module: Building History (read in English)

Intended Audience: Master program in rehabilitation engineering (1st semester)
Duration: 1 semester
Lectures and Tutorials: Scherer (co-ordination), Curbach, Haller, Herle, Herz, Pohl

Subjects: This module offers a short outline of essential aspects in building history covering the historical development of building technology from medieval times to present. Furthermore the correspondences between social conditions of living and working, the development of urban and suburban areas, the demands on engineering solutions, the development of engineering science and the institutionalisation of engineering education with its feedback to new solution capabilities are outlined. Each lecture is a self contained unit dealing with a special subject showing the development of technology and engineering on best practice examples.
The lectures are Historical Framework (Scherer), Geotechnical Engineering History (Herle), Timber Building History (Haller), Hydraulic Engineering History (Pohl), Bridge Engineering History (Curbach), Structural Engineering History (Scherer), Dresden Baroque (Herz).

Module: Environmental Informatics (read in English)

Intended Audience: Master program in rehabilitation engineering (2nd semester)
Duration: 1 semester
Lectures and Tutorials: Scherer/Faschingbauer/Katranuschkov

Subjects: This module is comprised of three parallel courses: (1) Information Management Systems, (2) Information Mining, and (3) GIS for Infrastructure Systems.
The first course introduces the methods for object-oriented modelling of complex engineering systems. Further course material focuses on communication methods and the formal representation of communication goals which allow the efficient application of automatic evaluation and decision support methods and algorithms. A third part of the course is specifically dedicated to the use of control methods and the development of a methodology for performance measurement.
The second course introduces methods for data analysis and data mining, such as correlation and regression, classification, decision trees and clustering, whose practical application aims at the early detection of damages and faulty system behaviour. In conjunction with that the scope of application and how the methods are complemented are discussed. Part of the course is specifically dedicated to data pre-processing since the efficiency of the methods strongly depends on the modelled data.
The third course provides an introduction into graph theory, by which the partitioning and the formal area-related variables dependencies can be described. The mapping from object-oriented data models to area-related representations and the generation of area boundaries by means of data mining methods are discussed. Different ways of graphical representation for complex, multi-layered information in terms of area magnitude are introduced. The lectures and tutorials provide insight into preferred modelling and data analysis techniques for corresponding graphical representation methods.

Course: Informatics in civil engineering

Intended Audience: 6th semester, students of science of the economy
Lectures and Tutorials: Hauptenbuchner

Subjects: This lecture aims at giving an introduction to the specific problems of software in civil engineering, the special requirement to the hardware, the way of work with the software and the future trends. Especially the area of the functionality of CAD- and CAE software will be discussed. The students get a survey of the software used in civil engineering offices and can acquire knowledge that allows them to judge such software products concerning quality and performance. A further aim is to enable the students to assess the expenditures on installation of new software, training of staff to operate it and carrying out of projects by appropriate software products.

Course: Informatics for Architects

Intended Audience: 1st semester, students of architecture
Duration: 1 semester
Lectures and Tutorials: Hauptenbuchner

Subjects: This course allows the students of architecture to acquire basic knowledge and skills in computerised data processing that will enable them to prepare multi-media documents of up-to-date quality. The course material generates skills for efficient practical use of operating systems, text and graphic processing software, calculation programs and databases as well as the interfaces between them. Because of their widespread use Microsoft Office products are particularly emphasised. A performance test after the course proves the knowledge of and proficiency in the use of Microsoft Office products, including the use of various interfaces for the preparation of a multi-media document on a subject chosen at liberty but according to well defined criteria.

Publications in 2006

[1] CEROVSEK T., KATRANUSCHKOV P.: Active Process Reuse Model for Collaboration, ITcon, Vol. 11, pp. 467-488, ISSN 1400-6529, http://www.itcon.org/2006/35, May, 2006.

[2] KELLER M., SCHERER R. J., MENZEL K., THELING T., VANDERHAEGHEN D., LOOS P.: Support of Collaborative Business Process Networks in AEC, ITcon, Vol. 11/2006, pp. 449-465, ISSN 1400-6529, http://www.itcon.org/2006/35, May, 2006.

[3] RADEVA S., SCHERER R. J., PASKALEVA I., RADEV D.: Seismic Estimation for Sofia Region with Neural Modeling, in: Rivard H. et al. (ed.) Proc. Joint Int. Conf. on Computing and Decision Making in Civil and Building Engineering, Montreal, Canada, June 14-16, 2006. Joint publication by ICCCBE-XI, ICCC-ASCE 2006, DMUCE-5, CIB-W78, CIB-W102, ISBN 2-921145-58-8.

[4] SCHERER R. J., FASCHINGBAUER G.: A Scalable Open Monitoring Platform Environment for Risk Management, Rivard H. et al. (ed.) Proc. Joint Int. Conf. on Compting and Decision Making in Civil and Building Engineering, Montreal, Canada, June 14-16, 2006. Joint publ. by ICCCBE-XI, ICCC-ASCE 2006, DMUCE-5, CIB-W78, CIB-W102, ISBN 2-921145-58-8.

[5] SCHERER R. J., WEISE M., KATRANUSCHKOV P.: Adaptable Views supporting Long Transactions in Concurrent Engineering, in: Rivard H. et al. (ed.) Proc. Joint Int. Conf. on Computing and Decision Making in Civil and Building Engineering, Montreal, Canada, June 14-16, 2006. Joint publ. by ICCCBE-XI, ICCC-ASCE 2006, DMUCE-5, CIB-W78, CIB-:W102, ISBN 2-921145-58-8.

[6] SCHERER R. J., KATRANUSCHKOV P.: From Data to Model Consistency in Shared Engineering Environments, in: Smith I. F. C. (ed.) „Intelligent Computing in Engineering and Architecture“, Revised Selected Papers from the 13th EG-ICE Workshop 2006, Ascona, Switzerland, June 25-30, 2006 (publ. in Sublib. SL7 of „Lecture Notes in Computer Science“, Vol. 4200/2600, pp. 615-626, Springer, Berlin–Heidelberg–New York).

[7] SCHAPKE S.-E., SCHERER R. J., KATRANUSCHKOV P.: Semantic Service Environments for Integrating Text with Model-based Information in AEC/FM, in: K. Gürlebeck & C. Könke (eds.): Proc. 7th Int. Conf. on the Applications of Computer Science and Mathematics in Architecture and Civil Engineering (IKM), Weimar, Germany, July 12–14, 2006.

[8] BRETSCHNEIDER J., SCHERER, R. J.: Identification of seismic wave fields by patterns in time-dependent principal correlation axes, First European Conference on Earthquake Engineering and Seismology, Geneva, Switzerland, Sept. 3-8, 2006, Paper 1288.

[9] EISENBLÄTTER K., DECKARM H., SCHERER R. J.: Context-sensitive information spaces for construction site applications, in: M. Martinez & R. Scherer (eds.) “eWork and eBusiness in Architecture, Engineering and Construction”, Proc. 6th ECPPM, Sept. 13-15, 2006, Valencia, Spain, Taylor & Francis Group, London, UK, ISBN 0-415-41622-1.

[10] GEHRE A., KATRANUSCHKOV P., SCHERER R. J.: Management and Integration of Virtual Enterprise Information on Grid Spaces Through Semantic Web Ontologies, in :M. Martinez & R. Scherer (eds.) “eWork and eBusiness in Architecture, Engineering and Construction”, Proc. of the 6th ECPPM, Sept. 13-15, 2006, Valencia, Spain, publ. by Taylor & Francis Group, London, UK, ISBN 0-415-41622-1, pp. 255-266.

[11] GÖKCE K. U., KATRANUSCHKOV P., SCHERER R. J.: IT Supported Construction Project Management Based on IFC and ISO 9001:2000, in: M. Martinez & R. Scherer (eds.) “eWork and eBusiness in Architecture, Engineering and Construction”, Proc. 6th ECPPM, Sept. 13-15, 2006, Valencia, Spain, Taylor & Francis Group, London, UK, ISBN 0-415-41622-1, pp. 513-521.

[12] KATRANUSCHKOV P., WAGNER U., WEISE M., SCHERER R. J.: Supporting Model-Based Cooperation in Distributed Web Spaces, in: M. Martinez & R. Scherer (eds.) “eWork and eBusiness in Architecture, Engineering and Construction”, Proc. 6th ECPPM, Sept. 13-15, 2006, Valencia, Spain, Taylor & Francis Group, London, UK, ISBN 0-415-41622-1, pp. 237-244.

[13] MENZEL K. KELLER M.: Errors and omissions management – new forms of collaboration, in: M. Martinez & R. Scherer (eds.) “eWork and eBusiness in Architecture, Engineering and Construction”, Proc. of the 6th ECPPM, Sept. 13-15, 2006, Valencia, Spain, publ by Taylor & Francis Group, London, UK, ISBN 0-415-41622-1.

[14] SCHAPKE S.-E., SCHERER R. J: Text Integration based on a Construction Information Resource Sharing Ontology. In: M. Martinez & R. Scherer (eds.) “eWork and eBusiness in Architecture, Engineering and Construction”, Proc. 6th ECPPM, Sept. 13-15, 2006, Valencia, Spain, Taylor & Francis Group, London, UK, ISBN 0-415-41622-1.

[15] SCHERER R. J., BRETSCHNEIDER J.: Data mining for associated temporal patterns of seismic waves, in: M. Martinez & R. Scherer (eds.) “eWork and eBusiness in Architecture, Engineering and Construction”, Proc. 6th ECPPM, Sept. 13-15, 2006, Valencia, Spain, Taylor & Francis Group, London, UK, ISBN 0-415-41622-1.

[16] SCHERER R.: Integrierte dynamische Produkt- und Prozessmodellierung mit dem Ziel der Risikobewertung von Bauprojekten, in: Wenzel S. (ed.) Simulation in Produktion und Logistik 2006, 12. ASIM Fachtagung, Kassel, Germany, Sept. 25-27, 2006, SCS Publishing House e.V., San Diego-Erlangen, ISBN 3-936150-48-6.

[17] DABAGH M. J.: Simulation und Modellierung der Prozesse im Bauwesen unter Verwendung von Petrinetzen, in: Koch Ch. et al. (eds.) 18. Forum Bauinformatik 2006, Verlag der Bauhaus-Universität Weimar, ISBN-10: 3-86068-291-1, ISBN-13: 978-3-86068-291-3, Weimar, Germany, Sept. 27-29, 2006.

[18] FASCHINGBAUER G.: Ein verteiltes Überwachungs-Leitsystem für Risikomanagement, in: Koch Ch. et al. (eds.) 18. Forum Bauinformatik 2006, Verlag der Bauhaus-Universität Weimar, ISBN-10: 3-86068-291-1, ISBN-13: 978-3-86068-291-3, Weimar, Germany, Sept. 27-29, 2006.

[19] SHARMAK W.: Process Modeling for a Construction Risk Management System, in: Koch Ch. et al. (eds.): Proc. 18. Forum Bauinformatik 2006, Verlag der Bauhaus-Universität Weimar, ISBN-10: 3-86068-291-1, ISBN-13: 978-3-86068-291-3, Weimar, Germany, Sept. 27-29, 2006.

[20] WAGNER U.: Objektorientierte Modellierung in einer integrierten Lernumgebung, in: Koch Ch. et al. (eds.): Proc. 18. Forum Bauinformatik 2006, Verlag der Bauhaus-Universität Weimar, ISBN-10: 3-86068-291-1, ISBN-13: 978-3-86068-291-3, Weimar, Germany, Sept. 27-29, 2006.

[21] SCHERER R. J., FASCHINGBAUER G.: A Concept of a virtual Platform System for Multi-Physical Monitoring of Complex Engineering Structures (in German), in: Ruge P. & Graf W. (eds.): Neue Bauweisen – Trends in Statik und Dynamik, 10. Dresdner Baustatik-Seminar ISSN 1615-9705, Dresden, Sept. 29, 2006.

[22] KATRANUSCHKOV P., GEHRE A., KELLER M., SCHAPKE S.-E., SCHERER R. J.: Ontology-Based Reusable Process Patterns for Collaborative Work Environments in the Construction Industry, in: P. Cunningham & M. Cunningham (eds.) „Exploiting the Knowledge Economy“, IOS Press, ISBN 1-58603-682-3, pp. 1055-1063, Oct. 2006.

[23] SCHERER R. J., WEISE M.: Towards Distributed Product Model Server Functionality in Web Spaces, in: Swarup P. R., Kumar B. (eds.) Proc. World IT Conf. for Design and Construction INCITE / ITCSED 2006, New Delhi, India, Nov. 15-17, 2006.

Editorial Boards Positions

Advanced Engineering Informatics	Elsevier Publishers	The Netherlands
Information Technology in Construction (electronic journal)	KTH Stockholm	Sweden
Construction Innovation	Arnold Journals Publisher	Great Britain

Membership in Standardization Groups

DIN Dok-Bau	Standardization committee for technical product documentation in civil engineering	Chairman
DIN NAM 96.4.1-3	Product data exchange in civil engineering	Vice chairman
ISO 10303/BC	Standard Exchange of Product Data, work group Building Construction	Member
IAI	International Alliance for Inter-operability, German Council (product modelling in AEC/FM)	Co-ordinator of the academic group
IAI/ST-4	ST-4 Structural Model	Vice chairman