

## ***KUE-Online – A Data-Management-System Supporting the Handling of Design Exercises***

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### **Keywords**

*EDM/PDM (Engineering/Product Data Management), Document and  
Workflow-Management, Internet/Intranet*

### **Abstract**

This contribution shows a way to introduce topics like CAD (Computer Aided Design) and EDM/PDM (Engineering/Product Data Management) into the lecture courses within the framework of the studies of Production Engineering at the Saarland University in Germany a very practical fashion. The students have the possibility to transfer digital documents of their design exercise solutions online using the Internet-portal of the supervising institute.

### **Introduction**

In this contribution a prototype-software is presented which manages the exercise documents connected with lecture courses in design. During the studies of Production Engineering at the Saarland University (as at every German university) the students have to prepare a considerable amount of homework ("Konstruktionsübungen"). The documentation includes different types of documents, such as text-files, spreadsheets, various calculations as well as CAD-models or drawings, FEM-models and so on. This is usually "processed" using a PC, but delivered to the supervisors still on paper. Today, however, a paperless process seems feasible and sensible.

The solution presented here is the data managing system *KUE-Online*<sup>1</sup> based on the Internet-technology. Besides this solution is a practical introduction in the field of Product Data Management (PDM), too. The main goal of this software is the workflow management of the exercise-processes as well as the document management of the exercises and the digital homework. The students can transfer their solutions to this system using the Internet. The supervisor automatically gets messages about newly arrived documents and can start the revision process. After the reviewing a document several notices for the student and for statistical evaluations are added. If the work is done well, the student gets an appropriate message. Overall, different criteria concerning security and time schedule are controlled. The following (main-) functions are provided:

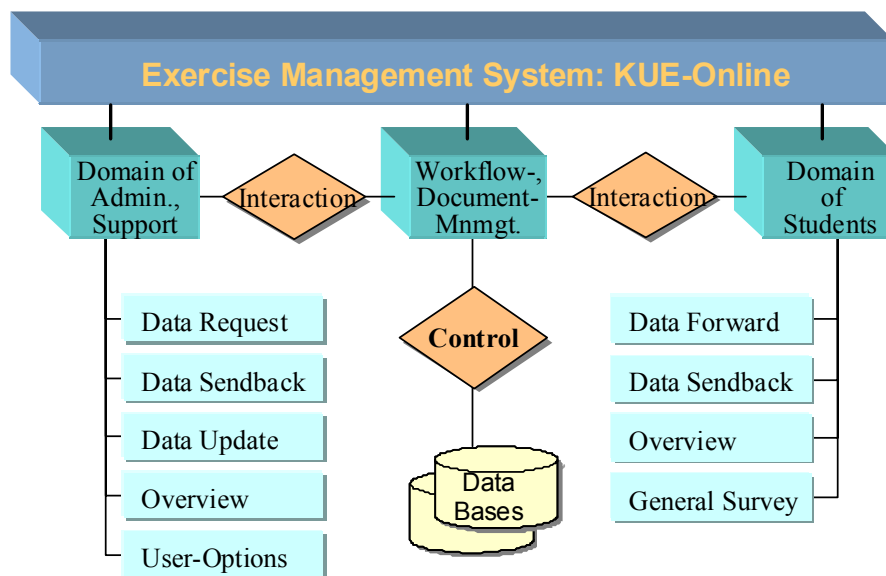
- Definition of exercises in the fashion of a project-definition
- Definition of a time schedule for the exercises

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<sup>1</sup> The name *KUE-Online* is derived from the german term „Konstruktionsübung (KUE)“, which denotes the homework-exercises of lecture courses in design.

- Assignment of different responsibilities
- Delivery, review and releasing of the homework-solutions
- Attention to security and time criteria
- Preparation of different surveys and evaluations

**Figure 1** shows the main structure of the software-system KUE-Online. The system is divided into three functional main parts: The first part used by the supervisors handles the administration and the support of the individual exercises during the definition phase, i.e. the task definition, time schedules, upload-functionality for the students and the overview over solutions already submitted. The supervisor gets a message automatically, if data material is checked in by a student. He can then download the material for review and can add correction notes or comments. If the review process is finished, the student gets a message, too. The second part of the system contains the functions for the students. They can download task information, send solution data, download the comments of the supervisor after review, and just derive some overviews of the state of the process and their results as well. The third part controls the interactions between the supervisors' and the students' domains. Also access to the central databases is controlled by the central workflow and document management.

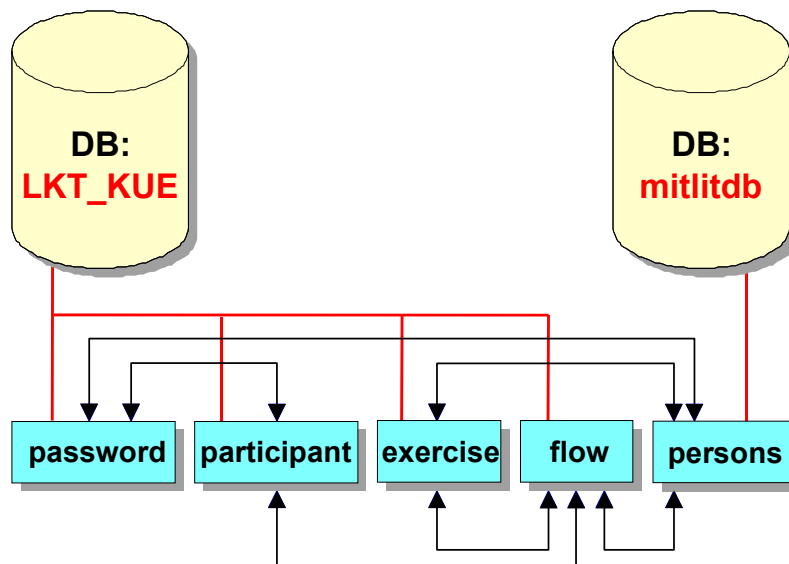


**Figure 1:**  
Structure of the  
KUE-Online-System

## Structure of KUE-Online and realised workflows

Because of the object oriented approach of the KUE-Online system, it is divided into two different databases (**figure 2**). The first database (called *mitlibdb*) keeps the personal data of the staff members (supervisors). This database is maintained outside this system by other tools and interfaces. The second database (*LKT KUE*) was designed to embody all the specific data of exercises and their processing by students and supervisors.

The communication between these two databases is carried out via dynamically generated tables. These tables are generated temporarily during a session. Their generation is done by corresponding scripts invoked by the central management system. The execution of a script as well as the way it is executed is controlled by specific entries in the tables themselves. Executing a script again leads to filling out some other fields of tables and sending appropriate contents back to the database *LKT\_KUE*.



**Figure 2:**  
Databases, tables,  
and interactions

A very important table (*password*) contains the encrypted passwords for accessing this system by the students. These passwords are independent from the password of the operating system to improve the security level. Students' data is added manually to the system (database *LKT\_KUE*) by a person of the staff using the table *participant*. The table *exercise* contains descriptions of the individual tasks which have to be solved by the students. Into this table also the deadlines for sending the (different stages of) solutions are written. The table *flow* is used to support the workflow of the exercise processing. All the relevant process information is stored in this table; this information consists of deadlines of data upload, the actual state of a process (waiting, working, stopped, uploaded, returned, ok, and so on). The table *persons* contains relevant staff member (supervisor) data extracted from the database *mitlitdb* and in this way (temporarily) links the databases *KUE\_LKT* and *mitlitdb*.

The data passed through the workflow management system and stored in the document management system can consist of office documents, CAD-models (2D-drawings as well as 3D-models and assemblies), FEM-models, calculations, simulations, scanned sketches. The supervisor can review this data by using the same software or an appropriate converter or a viewer-software with measurement and redlining functionality. The formats are specified by the responsible supervisor.

After a login, the student gets the window for downloading tasks of exercises or for sending his solutions. For sending a solution he/she can browse for his/her own data files and send them with some notices, or can download them again, if comments of the supervisor have been added. **Figure 3** shows two windows demonstrating the upload and download functionalities (from a student's view).

The processes running in the background are quite complex and not described in detail here. **Figure 4** describes them briefly with all control statements and loops. The reason for the complexity is the procedure of the exercises: Normally, the first deliverable of an exercise is the reflection of a solution concept. This concept must be approved by the supervisor before, in most cases after some modification, the student can continue with his work. The second deliverable consists of the documentation of the detailed solution.

Both in the domain of students and in the domain of supervisors some overviews and statistical data can be derived from the system. For example, students can ask for information concerning the current status of affairs (example: "concept sent to the supervisor, no review results sent back yet"), the supervisor can see status overviews for all students of his/her group (example: "student XYZ still hasn't delivered results", or better: "first and second approval rewarded to all students, processing this exercise finished"). Figure 5 shows two appropriate window-dumps.

**Bitte die notwendigen Daten einfügen und anschliessend senden.**

[KUE-Daten senden](#) [KUE-Rückfordern](#) [KUE-1.Übersicht](#) [Gesamtübersicht](#)

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**Konstruktionsübung: 1**      **von: Basem Khalaf**  
**Betreuer:**      **Oliver Thome**  
**Gruppenleiter:**      **Bertram Hans**  
**Information zu KUE**  
**Abgabetermin Vortestat:**      **15-3-1999**  
**Abgabetermin Endtestat:**      **20-3-1999**

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☒ **Die Daten der KUE-1 für den nächsten Abgabetermin sind in der Datenbank vorhanden.**

**Berechnungen :** Abgabe in \*.doc Format.  
 **Durchsuchen...**

**CAD-Daten :** Abgabe in \*.jpg, gif, vml Format.  
 **Durchsuchen...**  
 **Durchsuchen...**  
 **Durchsuchen...**

**Anmerkungen:**

- Die Sendung von Dateien nach Abgabetermin wird zu nichts führen !  
- Alle Daten die vorher gespeichert waren gehen hiermit verloren !

**Sie können jetzt die Daten downloaden und bearbeiten.**

[KUE-Daten senden](#) [KUE-Rückfordern](#) [KUE-1.Übersicht](#) [Gesamtübersicht](#)

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**Abgabetermin Endtestat:**      **20-2-1999**

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**Download:**  
[Berechnungen](#)

**Keine Kommentare vorhanden.**

[Zurück zur Willkommen-Seite](#)

**Speichern unter...**

Speichern in:

Dateiname:

Dateityp:

**Figure 3: Windows for upload and download**

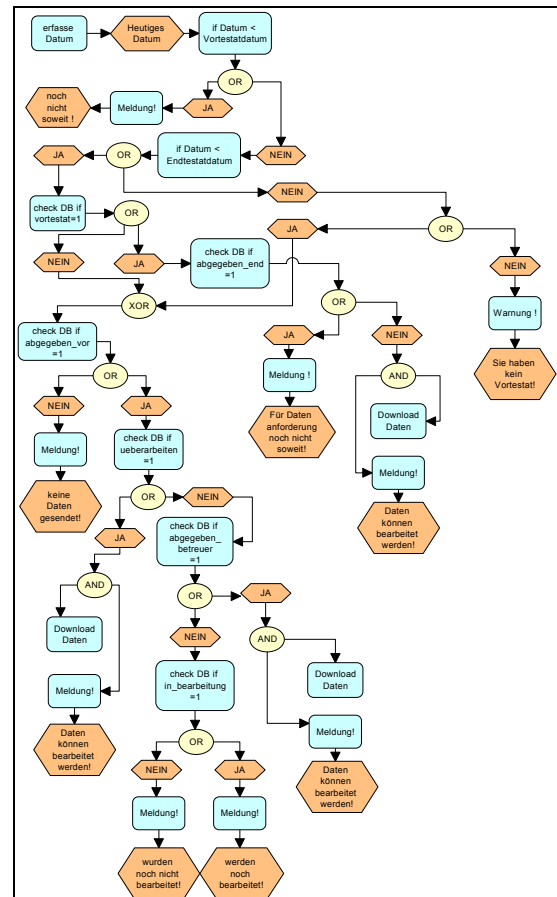
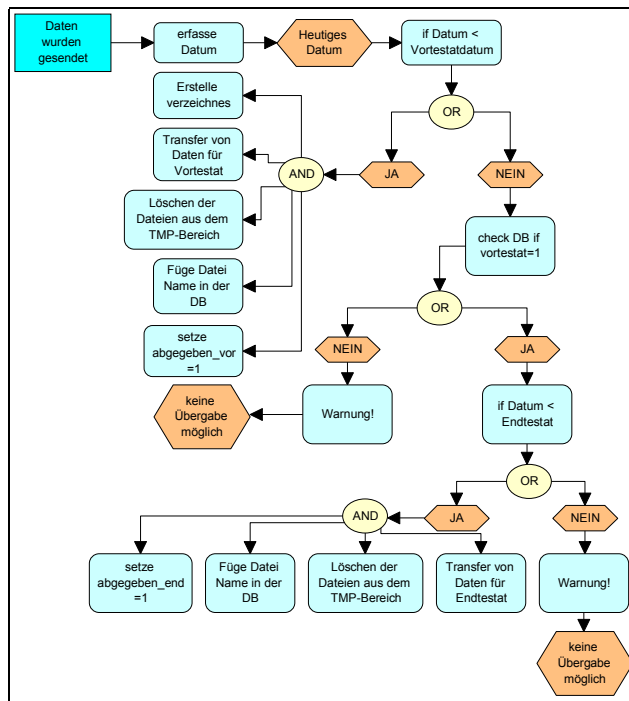


Figure 4: Corresponding processes for upload and download (in German)

☒ Vortestatdaten gesendet
 ☐ Vortestat erhalten

☐ Endtestatdaten gesendet
 ☐ Endtestat erhalten

☐ Daten sollen überarbeitet werden

Sie haben folgende Daten zur der KUE-Datenbank gesendet:

Eine Doc-datei: **Musterfrau.Berechnungen.doc**

Eine CAD1-datei: **Musterfrau.Zeichnung1.jpg**

Eine CAD2-datei: **Musterfrau.Zeichnung2.vrml**

Den folgenden Kommentar gesendet: **und hier noch eine Bemerkung in ...**

Gesamtübersicht von KUE-1						
Nachname	Vorname	Matrikel Nr.	Datenabgabe Vortestat	Vortestat	Datenabgabe Endtestat	Endtestat
			JA / NEIN	JA / NEIN	JA / NEIN	JA / NEIN
Mustermann	Karl	1111111	<input checked="" type="checkbox"/> / <input type="checkbox"/>	<input type="checkbox"/> / <input checked="" type="checkbox"/>	<input type="checkbox"/> / <input checked="" type="checkbox"/>	<input type="checkbox"/> / <input checked="" type="checkbox"/>
Musterfrau	Elfriede	2222222	<input checked="" type="checkbox"/> / <input type="checkbox"/>	<input type="checkbox"/> / <input checked="" type="checkbox"/>	<input type="checkbox"/> / <input checked="" type="checkbox"/>	<input type="checkbox"/> / <input checked="" type="checkbox"/>

Figure 5: Generated overviews for the student (top) and the supervisor (bottom)

## Technical infrastructure

This software system was implemented using of the following software-tools:

1. Apache Web-Server
2. MySQL Database
3. Internet pages written in HTML (Hyper Text Markup Language)
4. PHP3 as server-side HTML-embedded scripting language
5. JavaScript for the server/client communication
6. Internet Browser (Netscape or Microsoft Internet Explorer)

The implementation has shown that such a document- and workflow-management system can be realised without expensive software. The time for implementation was about six month. The realised processes show quite some complexity, however, which was not anticipated in the beginning.

The data management system *KUE-Online* is a relatively simple form of a workflow management system. It controls, however, all operating processes within the framework of defining tasks and dates for design exercises, submitting solutions, reviewing and evaluating them. An extended functionality would be conceivable to cover all homework-type projects during studies.

## Benefits

Both, the students as well as the supervisors have benefits out of the solution shown here. At first, the students save time in delivering electronic data directly from their PC. The time for the review-process is reduced as well as its cost due to the renunciation of paper prints. A more convenient communication is introduced with the use of notices and comments in an asynchronous way. A further advantage is getting students acquainted with ED/M/PDM- and workflow-technology as well as a “fun-factor” in using such an exercise management system. An archive of exercises and corresponding solutions can be built up simultaneously with this system.

## Acknowledgement

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