New synergy from linking processes

Authoring system for e-Engineering can also manage data from participating systems – including M-CAD.

The tension between information demand and data flow

Every engineer is familiar with the problem: Often, a great deal of information from neighboring areas is needed for the next important work stage - but if you dip into all these areas, the data flow becomes extremely impenetrable and the overview disappears. Particularly during project design, but also during maintenance or conversion planning for machines and plants, it is becoming increasingly important to include data from various disciplines or viewpoints. Twenty-first century engineering therefore needs a common basis of data for all e-planning stages and corresponding systems. Not only does this offer significantly greater safety, it also minimizes the massive expense of interfaces, which today is still the price for the transparency being demanded on all sides.

To give an example: Drives used in a plant now contain very much more data than even just a few years ago, and they maintain relations to other objects or information and can leave traces on many kinds of documents. They are no longer just shown on a circuit diagram, but also feature as a destination in a cable assignment list or a terminal plan, in a plant overview as a single-line diagram, or in the parts list. They maintain relations to the control software that is controlling them - and if they have on-board intelligence, they may also have a bus address. If a pump is being driven, this can involve relations with hydraulics, with its corresponding documents.

In addition to these data trails, which an object leaves behind just in relation to the automation engineering view, there are the mechanical trails such as representation in a 3D model or the wish to have access to data sheets or descriptions from the device manufacturer. In an existing plant, there is then also managing the drive as a plant object or the corresponding servicing schedules to consider. Depending on the actual use, this list can be continued much further.
While those involved in planning processes want to use or process information from this body of data in a targeted manner, for those who have to handle data administration it presents a question as to how to manage, archive, provide and store this data securely.

PDM archiving renders documents ‘stupid’

Since for a long time the authoring systems – in other words, the tools used to create data or documents – covered just one of the many disciplines concerned, what are known as EDM, PDM or PLM systems have evolved with the aim of standardizing data maintenance and provision. They form the shared brackets embracing all authoring systems, accepting the data created, cataloging it and, if necessary, supplying it again for processing in its original format, but also for viewing in a neutral format (TIFF, PDF). To achieve this, these systems are compelled to restrict themselves to the smallest common designators, i.e. the data from the individual authoring systems are encapsulated (in the container). But as a result the objects within the containers lose their connectedness. The example used above, the drive assembly, is found on the circuit diagram in the E-CAD system (and thus in its container), in the hydraulic diagram in another system, and so on. With a lot of luck, it is possible to find out which documents the drive features on, but direct navigation between the documents for the individual

disciplines is generally only possible with a lot of effort during data preparation. And if, as is so often the case, the electrical engineering documents are checked in as individual PDF or TIPP pages in the PDM, then even there the high degree of data connectedness (wiring, references, multiple representations etc.) cannot be found again or used for intelligent navigation. In other words, the data is stored safely, documents can be located via their cataloging, but in terms of content it is 'brain-dead'.

Combining authoring system and an intelligent data basis

The way out of this dilemma is now coming from the authoring system side. For instance, the software professionals at Aucotec AG undertook a fundamental examination of the disciplines involved with that aim in mind, to see whether their areas of work are tightly or loosely connected with one another. The decisive aspect was not that the people or departments involved had worked closely together in the past, but that the potential for collaboration existed. High affinity exists, for example, if the same real object in a plant features in various logical contexts in the documentation or in the engineering. It becomes particularly attractive if references are also needed between the documents, and later users of the data, e.g. in plant maintenance, might use these for navigation. As the first provider to do so, Aucotec AG (whose planning software was previously geared to electrical engineering documentation) recognized this opportunity and created a system for a new category of solutions.

In Engineering Base (EB), the Hanover-based system house developed an authoring system for logical plant description with a database-based client/server architecture; the system can also manage data from other systems involved (3D engineering, control software, etc.). It is an ultra-effective approach, since logical data has the highest degree of connectedness, such as between hydraulics diagrams and electrical circuit diagrams, or between the individual pages of the circuit diagram themselves. The ground-breaking and unique platform is not limited to graphical documents, however, but models the plant objects themselves. Although the user of the electrical engineering authoring system customarily works in the circuit diagram, EB not only stores all objects as symbols, but describes them fully alphanumerically. This makes it possible to retain far more information than is necessary simply for connection planning – e.g. materials data, specifications, etc.

A cooperation platform for plant designers, constructors and service staff

The same user, or another user, can also process the same object either purely alphanumerically in a list view or in adaptable dialogs. The necessary consistency is ensured via the common data basis. This means that several disciplines, such as hydraulics, electrics and parts list processing, are integrated in one authoring system with associated data storage. Further candidates for this close coupling are all disciplines with strong logical contexts, such as single-line diagrams, mechanical 2D configuration diagrams (control cabinet), hall plans with cable runs, etc. In addition, the tool offers the possibility of linking to documents from other systems. These links can be provided both to external data and also within the database (third-party data embedding); the latter makes particular sense if the data is project-specific, thus for example if it is sent with the project to end-customers.

M-CAD integration in control cabinet planning: The prototype rendered superfluous

Even on data from other authoring systems, Aucotec is working on using its navigability – for instance, in relation to the drive in the example from earlier, not just to know in which 3D model it features, but to navigate there directly and in a further step to feed back the common data, such as describing attributes, directly from the engineering database into the 3D system. In relation to control cabinet construction, an approach of this type has already been successful.

At the heart of EB's machine construction solution is easy and straightforward control cabinet construction using 2D and 3D components. Its routing autonomously and automatically determines the optimal run for cables in the control cabinet, and simultaneously calculates its precise length. In doing so, the tool takes EMC categories into account. After this, EB immediately displays the percentage fill level of all cable ducts used, in a table. This listing also includes the branching coordinates of the wires, and all ducts which a wire needs to run through in the control cabinet.

With the help of EB's 3D control cabinet configurator, all 2D positions also appear instantly in the 3D model, without this calling for special 3D expertise on the user's part. The 3D solution, developed in cooperation with SolidWorks partners, facilitates fine reconciliation of positioning in the model and inserting additional mechanical parts, such as fastenings or storage systems. Then the constructor can use SolidWorks to run thicker cables outside the cable ducts straightforwardly by hand. The specifications in 3D are fed back via the configurator to EB's data model, where this information is available in all views. A prototype is no longer required, there is a saving on costly cabling material, and the collision check arises from the model.

The system automatically supplies control cabinet production with wiring lists and cut-to-length lists, together with a machine-readable format for assembly plate manufacture. In addition, the wiring runs in the cabinet can be displayed as bundles or individually, and the component-related manufacturing parts list can be downloaded in up-to-date format at any time. EB supports labeling and label print-out automatically by passing on the corresponding lists for printing.

This sees us clearly on the path to fully-integrated engineering – one which offers a number of attractive prospects for the large part of the 21st century which still lies ahead.