KONWERK - A Domain Independent Configuration Tool

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Abstract

In the demo presentation, a domain independent tool for configuration (called KONWERK) is demonstrated. The functionality of basic aspects, like representation of domain objects, as well as enhanced aspects, like modeling of complex requirements is included in KONWERK. These aspects are used for developing diverse applications. A domain independent interface can be used for presenting the underlying concepts of KONWERK.

Methods for configuration

In the demo presentation, a domain independent tool KONWERK for configuration is demonstrated. A fundamental assumption with the development of KONWERK is that the efficient, economic employment of knowledge-based methods can only be successful if a domain independent tool can be made available and can support problem-specific aspects of configuration problems. Basically such aspects include:

- Representation of domain objects and their properties
- Representation and processing of relations and restrictions
- Configuration-task formulation and
- Control of the configuration process

In addition to these standard mechanisms conceptual (further-reaching) methods are available in the framework system KONWERK. To avoid unnecessary complex mechanisms and to give suitable concepts for different domains KONWERK provides diverse problem-solving modules which are built on each other. Thus, for the basic aspects mentioned above basic modules are implemented, and for further-reaching methods enhancement modules are developed. Examples for enhancement modules are:

- Modeling of complex requirements
- Functional modeling
- Simulation of configured systems
- Use of case-based reasoning
- Fuzzy arithmetic
- Resource-oriented configuration
- Several conflict resolution techniques

Applications

To build an application with KONWERK, i.e. a configuration system for a specific domain, firstly necessary modules are selected from the module set of KONWERK and then appropriate knowledge bases are modeled by using knowledge descriptions provided by each module.

KONWERK allows several applications from different domains to be developed:

- Selection and arrangement of friction bearings
- Configuration and dimensioning of jointed shafts
- Design of liquid crystals
- Configuration of passenger cabins in vehicle aircrafts
- Configuration of hydro-geological models
- Configuration of elevators (VT-domain)
- Modeling of bills of materials in automotive production
- Arrangement and dimensioning of drive control systems

The heterogeneity of the considered applications, which include several of the specified aspects, ensure the usability of KONWERK for a wide range of application problems.

Implementation

For the implementation of the modules diverse techniques are used, such as concept hierarchies to represent domain objects, constraints to represent relations and restrictions on domain objects, and a blackboard architecture to control the configuration process. The underlying assumption is that configuring is an incremental process, where the solution (a configuration) is build successively. Thus, for instance the constraint net increments, i.e. necessary constraints for newly created objects are automatically generated and added to the increasing constraint net.

Domain independent browsers and dialogs are shown in the demo presentation. The interface is designed for knowledge engineers who are interested in the underlying concepts of KONWERK. Thus, a knowledge-base browser for presenting both all parts of the static knowledge-base (i.e. domain objects, constraints, control knowledge, hierarchies etc.) and the dynamic knowledge-base which is created during a configuration process. This knowledge-base includes dialog interactions, a constraint-net browser,

the elaboration net (i.e. an incremently increasing net of partly configured objects), and a tracer for displaying configuration subtasks.

KONWERK is written in Common Lisp, CLOS (Common Lisp Object System), and CLIM (Common Lisp Interface Manager) and runs under Windows NT, Windows 95, and UNIX. For non-commercial institutions KONWERK will be available for free from the authors. Currently the experiences made with KONWERK influence the development of a new commercial system called "EngCon".

Acknowledgments

References

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