A Knowledge-Based System Engineering Process for Obtaining Engineering Design Solutions

Brian Prasad and Jeff Rogers

[+] Author Affiliations

Paper No. DETC2005-85561, pp. 477-488; 12 pages

doi:10.1115/DETC2005-85561

From: **ASME 2005 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference**

Volume 3: 25th Computers and Information in Engineering Conference, Parts A and B

Long Beach, California, USA, September 24–28, 2005

Conference Sponsors: Design Engineering Division and Computers and Information in Engineering Division

ISBN: 0-7918-4740-3 | eISBN: 0-7918-3766-1

ABSTRACT

abstract

Designing and developing highly engineered products requires direct (and more dynamic) associations between customers' specifications and product characteristics (or its behaviors). In order to meet the specified customer performance, cost, and integrity goals, a multitude of specialized analyses, heuristics, shortcuts, look-up tables, equations, algorithms, finite elements, and material substitution at multiple levels (system, subsystems, components and parts) are ought to be performed. The product geometries of such engineered product are often complex and many parts are designed interactively from scratch using a 3D commercial computer-aided design (CAD) — lately often referred as Product Life-cycle Management (PLM) system. Today, this very *"PLM-based"* engineered product-design process is often "static", very "feature or geometry-dependent," "knowledge-intensive," and therefore, engineers often takes considerable time (months) to complete this manual process. Today, more and more companies want to quickly reengineer a product from a multitude of family solutions (corresponding to various design trade-off studies). They are interested in some dynamic form of a decision-based system that could automatically filter through a multitude of historical product solutions and quickly reconfigure one that meets the customer requirements with the least cost, weight, and time investment. Such decision-based product automation is not an easy task by any means. Product definitions without knowing specific geometry are hard to conceive, capture generically, and reuse widely (via any generative tool). A typical product development process —by its nature—is highly dynamic, nonlinear, discrete, feature-dependent, and part-dependent. The solution is not easy, since problem formulation is time-bound, has numerous discrete inputs, topologies, and several mathematical discontinuities. This paper discusses the system architecture of the *Knowledge-driven Automation* (KDA) program — established at Parker in 2002. It addresses many of the above product development issues and problems. In particular, authors describe a *Knowledge-based System Engineering Process for Obtaining Engineering Design Solutions in a Commercial PLM Setting*. The architecture and solutions use a number of innovative knowledge-based engineering (KBE) concepts and procedures. Through strategic use of generative modeling, spreadsheet tables, part and assembly templates, system engineering concepts, and our proprietary "smart part concepts," authors were able to *engineer-to-configure* a family of hydraulic actuators automatically from their customer specifications using a set of PLM (CATIA V5 and its underlying knowledgeware) tools.

Topics: Systems engineering , Engineering design

Proceedings of the Eighth International Conference on Probabilistic Safety Assessment & Management (PSAM)

Utility Function Fundamentals
Decision Making in Engineering Design> Chapter 3

Normative Decision Analysis in Engineering Design
Decision Making in Engineering Design> Chapter 4

[+] View More

Topic Collections

Design Engineering
Dynamic Systems & Control