EREP Project Overview

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The EREP project develops a neutral CAD representation that supports feature-based, constraint-based design and permits a high level of abstraction. We sketch the architecture that has been adopted to accomplish this objective and explain a number of technical issues that arose. These issues derive from the requirements to support variational constraints, to support feature-based design and editing, and to keep the representation independent of a CAD system that might be used to support implementing the system.

Introduction

A common problem in CAD-based product design is the inability to exchange design data that incorporates features and constraints. A number of standardization efforts have recently been initiated, for instance the Parametrics interest group organized within the conceptual landscape of the emerging STEP product data standard. These efforts are destined not to achieve complete CAD system interoperability because of intrinsic problems that originate from variational constraint-based design.

The EREP[2] project, begun about three years ago in collaboration with Professor Robert Joan-Arinyo of the Polytechnic University of Barcelona, has developed such a representation and has implemented a prototype system that demonstrates the viability of the representation.

To devise a neutral design representation that supports features and constraints requires solving certain technical problems that arise from the interaction of the design schema, devised by the user, with the constraint schema and the feature mechanism. These problems go well beyond choosing information models of the data that is to be communicated, and require an algorithmic

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[2]EREP stands for *editable representation.*

D. Roller et al. (eds.), *CAD Systems Development*

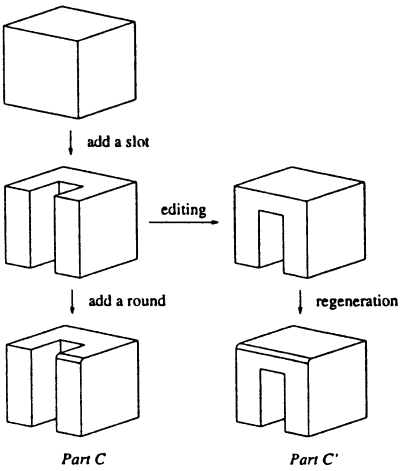

Figure 1: Example of editing semantics

semantics that has eluded many researchers and CAD vendors to date. This synopsis briefly summarizes the technical problems and guides the reader to publications that detail ways of addressing them.

The adoption of a neutral representation carries many benefits, among them CAD system interoperability, a well-understood semantics of design operations that presently may differ significantly between CAD systems, and the promise of functional interoperability between major functional tasks involved in effective product design by computer. These benefits have been characterized in [HJ93]. When the neutral representation departs from the tradition to include a full boundary description of the current design instance, moreover, a great economy of storage can be achieved that is orders of magnitude smaller than conventional representations.

Semantics of Editing Designs

Commercially available CAD systems support design paradigms deeply influenced by allowing the user to define features. A user-defined feature is elaborated based on a constraint schema. The constraint schema does not necessarily prescribe procedurally how to solve the constraints given specific values for dimensions and angles. This style of *variational constraint solving*[3] requires us to distinguish a generic design from design instances.

For example, if a block is defined with constraints on length, width and depth, then the generic design is the block with this constraint schema. Its

[3]The term appears to originate in industrial CAD circles.