With Leo Joskowicz, I have developed a representation language for conceptual design of mechanical devices. The language uses a mixture of predicates and algebraic relations to describe a mechanism's parts, positions and motions, allowing abstract, incomplete, and underspecified descriptions of behavior. The main contribution of this language is that it cleanly and simply captures the incomplete nature of design specifications. We have also partially implemented a design verification algorithm based on the language[2].

With Dan Weld, I am implementing a design generation system that completely and irredundantly generates designs from a fixed library of components. SIE (systematic iteration explorer) builds on William's interaction based invention[4]; however, we use a simpler testing strategy for potential designs as well as a systematic algorithm. We plan to continue with this line of research, implementing different testing strategies and heuristics in order to test if the combinatorial explosion inherent in design from first principles can be tamed[3].

One future avenue for my research is the local Electronic Encyclopedia project, a kind of electronic “How Things Work” book[1]. Typical articles will describe such devices as compression refrigerators, engines, telescopes and linkages. Each article will provide simulations and laboratory areas that allow a user to modify the device or experiment with related artifacts, and a facility for asking questions and receiving customized, computer-generated English-language explanations.

My work on mechanism design will impact this project in several ways. First, my implementation of SIE requires similar modeling techniques as the encyclopedia's simulation modeling; thus I am working with the team of students who are implementing the current version. Second, although the main thrust of the project is animating and simulating devices that the user creates, generating devices automatically per user constraints is a useful and educational extension of the encyclopa's scope.

References


