Progress and Challenges in Generative Product Design: A Review of Systems

ABSTRACT

Design is a challenging task that is crucial to all product development. Advances in design computing may allow machines to move from a supporting role to generators of design content. Generative Design systems produce designs by algorithms and offer the potential for the exploration of vast design spaces, the fostering of creativity, the combination of objective and subjective requirements, and the revolutionary integration of conceptual and detailed design phases. The application of generative methods to the design of discrete, physical, engineered products has not yet been reviewed. This paper reviews the Generative Product Design systems developed since 1998 in order to identify significant approaches and trends. Systems are analyzed according to their primary goal, generative method, the design phase they focus on, whether the generation is automatic or interactive, the number of design options they generate, and the types of design requirements involved in the generation process. Progress using this approach is recognized, and a number of challenges that must be addressed in order to achieve widespread acceptance are identified. Possible solutions are offered, including innovative approaches in Human–Computer Interaction.