SOLVING INTERVAL CONSTRAINTS IN COMPUTER-AIDED DESIGN

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Currently available CAD systems require geometric parameters to have fixed values. Valid range information on parameters cannot be properly represented and embedded in existing CAD data. Specifying fixed parameter values implicitly adds rigid constraints on the geometry, which have the potential to introduce conflicts during later design stages.

In this paper, a geometric modeling scheme based on nominal interval representation and analysis is presented to represent design uncertainty and inexactness. Parameters are represented by nominal intervals, which contain the information of nominal values, lower bounds, and upper bounds. Interval constraints represent inexactness at the early design stages, uncertainty in the detailed design, as well as the boundary information for design optimization.

To solve under-constrained and over-constrained interval problems, iteration-based equation solving methods are used. A generalized nonlinear constraint solving method based on linear enclosure is developed for fast convergence. Inequalities are transformed into equations and can be solved uniformly. Interval subdivision and constraint re-specification methods are developed for design refinement. Active and inactive constraints are differentiated in sensitivity analysis.