

INTELLIGENT DESIGN OF THE AUTOMOBILE FIXTURES WITH GENETIC ALGORITHMS

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ABSTRACT. *The design of automobile fixtures should meet several interference-free requirements while locating modular fixtures, e.g. (1) be interference-free between various fixture modules, (2) be interference-free between workpieces and fixture modules, and (3) be interference-free between machining tools and fixture modules. Furthermore, a good design also needs to minimize the cost by selecting proper fixtures from the existing modular fixture set under the clip-force limitations in the specification. Hence, the real-coded genetic algorithm (RGA) is proposed to resolve the optimization problem which should simultaneously infer the suitable mechanisms, satisfy multiple complex constraints, and achieve the cost-minimum requirement. To handle the complex reasoning, a two-phase inference flow is adopted in the evolutionary loops to inversely estimate the fixture mechanism parameters first and then verify the spatial geometry constraints through the direct kinematics characteristics. Compared to the traditional trial-and-error method, the design approach proposed in this work is obviously cost-effective and time-saving because of the complete and automated solution.*

Keywords: Automobile Fixtures, Interference-free, Genetic Algorithms

1. **Introduction.** Modular fixtures have been adopted in many small-batch automobile productions because of the advantages of lower cost and increased flexibility when switching different but similar workpieces. Figure 1 shows a layout example for welding and fixturing an automobile door panel. In contrast to dedicated fixtures, the design of automobile fixtures usually has to select fixtures from a reusable modular set with different mechanism types and reconfigure them according to different workpieces.

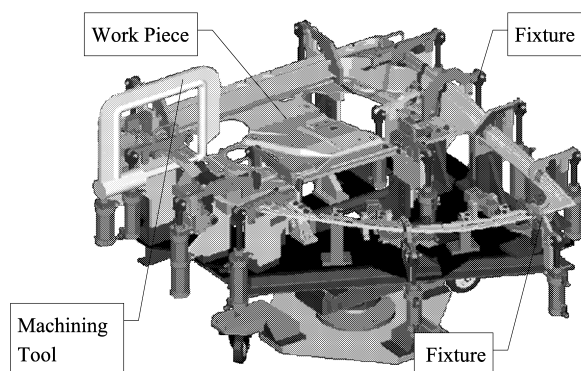


FIGURE 1. A design example for automobile door fixtures