基于改进遗传算法的车削加工中心工步排序与优化 Worksteps Sequencing and Optimization of Mill/turn Machining Center Based on Improved Genetic Algorithm

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摘 要： 多主轴多动力刀架车削加工中心工步排序问题是同时涉及资源调度和工步排序的复杂问题。提出一种改进遗传算法以解决结合工艺资源调度的车削加工中心工步排序问题。通过建立0-1混合整数规划模型，为算法提供目标函数及约束，并根据此模型中多参数多约束的特点，设计了一种基于结构体的编码方法。为改善算法性能，根据相邻基因间的相似程度，构造了多概率交叉算子与多概率变异算子，从而提高由相邻基因组成优秀基因段遗传至下一代的概率。实例表明该遗传算法具有可行性与有效性，并且较传统遗传算法在解决该类问题方面具有更好的收敛性。 Mill/turn machining center can perform several operations simultaneously with multiple spindles and power turrets, which means worksteps sequencing should be integrated with scheduling. According to the characteristics of mill/turn machining center, an improved genetic algorithm to optimize worksteps sequence was proposed. A 0-1 mixed integer programming model was set up to support the algorithm with object function and constraints. In order to present so many parameters of the 0-1 mixed integer programming model, coding strategy was developed based on data structure instead of integer or symbol. According to the similarity of genes, two novel genetic operators named multi-probability crossover operator and multi-probability mutation operator were also introduced. Consequently, these genetic operators insure that chromosomes consisted of genes with more similarity could transmit their characteristics to next generation with higher probability. The effectiveness of the proposed algorithm was verified by a real case using dual spindles and twin power turrets mill/turn machining center. The results also indicated that the improved genetic algorithm gained a better performance than the conventional genetic algorithm.

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