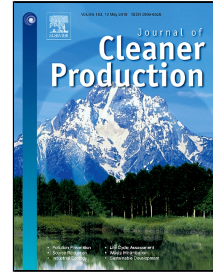


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A two-stage optimization method for energy-saving flexible job-shop scheduling based on energy dynamic characterization

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Abstract

Scheduling can have **significant** impacts on energy saving in manufacturing systems. The complex process constraints and dynamic manufacturing tasks in flexible manufacturing system make the scheduling a complicated nonlinear programming problem. To this end, this paper proposes a two-stage **energy-saving** optimization method for **Flexible Job-Shop Scheduling Problems** (FJSP). In this method, an operation-based integrated chart is firstly proposed to reveal the dynamic characteristics of the operations, enabling the energy-saving scheduling optimization. Then the optimization **is conducted** at two stages: **the** machine tool stage and **the** operation sequence stage. A Modified Genetic Algorithm (MGA) is applied **at** the first stage and a hybrid method that integrates Genetic Algorithm (GA) with Particle Swarm Optimization (PSO) is **adopted at** the second stage. Finally, a case study is employed to illustrate the applicability and validity of the proposed method. The results revealed that the **proposed** method can effectively optimize FJSP. This may provide a basis for decision makers to utilize a manufacturing scheduling that is optimized **regarding its** energy saving.

Keywords: Flexible job-shop scheduling problem; Energy-saving scheduling; Energy consumption; **Modified** Genetic Algorithm; Particle Swarm Optimization

Nomenclature

| | | | |
|----------|--|-----|-----------------------------|
| GA | Genetic Algorithm | PSO | Particle Swarm Optimization |
| MGA | Modified Genetic Algorithm | | |
| FJSP | Flexible Job-Shop Scheduling Problems | | |
| α | The weighting value of integrating energy consumption and production cost | | |
| C_0 | The dimensionless production cost matrix of machining operations for jobs | | |
| C | The total production cost of a scheduling task | | |

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