Multiobjective Genetic Algorithm for Rolling-Horizon Production Planning

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Abstract

An innovative rolling-horizon production/ inventory (PI) production management and control system is proposed. A multiobjective genetic algorithm (MGA) approach is designed as a solution to .the production planning problem in this system. Simulations demonstrate this system is a noted improvement to any of existing techniques, and also in practice, provides a new trend of integrating the manufacturing resource planning (MRP-II) and just-in-time(JIT) together.

1. Introduction

In order to achieve the best possible PI management and control result, integration of MRP-II and JIT has become an active research area [1]. Existing methods cannot respond to the changing market timely due to the fixed master production scheduling and planning (MPSP) horizon. This paper presents an innovative PI management and control system with rolling-horizon production planning is proposed. Meanwhile a MGA approach is designed to solve the involving optimization problem.

2. Current Research

The main feature of the proposed rolling-horizon PI management and control system is that a make-to-order integration of MRP-II with JIT approach can be realized One of its essential components is showed in Fig. 1.

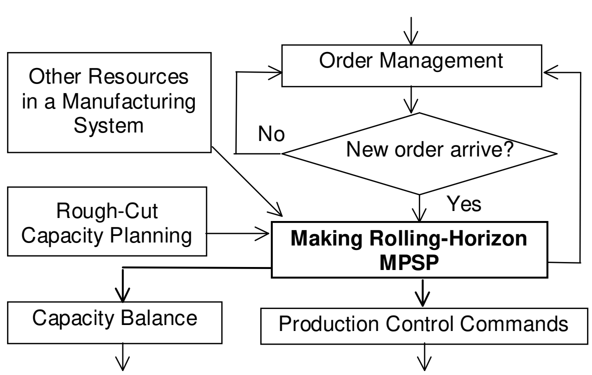

Fig. 1 Rolling-Horizon MPSP Procedure

Objective functions of the MPSP problem in this system include,

1) the number of unbalancing processes,
2) the cost of early production penalties, and
3) the cost of tardy production penalties.

Three objective functions are to be minimized to achieve a MPSP. Constraint functions include,

1) the process capacity constraints, and
2) the production quality constraints.

They should satisfy some prefixed conditions.

A MGA approach is designed as a solution [2,3]. In the process of optimization, the MO functions may be not minimized simultaneous manner. A Parato-based ranking technique can be used to quantify the available chromosomes.

3. Simulations

In the conventional systems, the new-arrival order can only be considered in the next horizon. Whereas in the proposed system, a new MPSP procedure can be triggered by the arrival of this new order, then an updated ETPSP can be made. An MPSP problem in a 12-period horizon shows that the proposed system with MGA approach is more effective. An important and extra feature of this MOGA approach is the trade off between different objectives[4]. Managers can inject their favorite according to different marketing requirements and capacity balancing by emphasizing some certain objectives. Moreover, it can handle large-scale practical problem.

4. Conclusion

The proposed make-to-order rolling-horizon PI production management and control system with a MGA approach can integrates MRP-II with JIT effectively. The designed MOGA approach is effectively for realistic large-scale problems. It is a noted improvement to any of existing techniques, and also in practice, provides a new trend of integrating the MRP-II and JIT together.

References

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