結合多目標與遺傳基因演算法於彈性製造系統排程之應用

張俊仁 、駱景堯

E-mail: 8603911@mail.dyu.edu.tw

摘 要

彈性製造系統（Flexible Manufacturing System：FMS）融合了許多自動 化的觀念與彈性技術於單一的生產系統中，是一種多種類少量的彈性生產 方式[1]，在生產上擁有途程彈性之特性，使得傳統的單一途程規劃轉變 成多途程規劃加工背景的排程問題，除需考慮各工件的加工順序外，還需 考慮各作業選擇的加工機器問題，增加了排程問題的複雜度。本研究使用具求解最佳解能力的遺傳基因演算法（Genetic Algorithms）結合處理多 目標（Mutiple-Objective）的歸屬函數（Membership Function)之觀念 發展一套求解彈性製造系統排程的啟發式解法，同時考慮最小化的平均遲 延時間、平均流程時間、最大化的平均機器使用率三個排程績效指標，以 求得一滿意的妥協解，使得發展之啟發式解法更具效率（Efficiency）與 績效（Performance），相信對實際的應用必有所助益。研究最後，針對 遺傳基因演算法執行中系統參數做一實驗設計找出最佳參數組合，以增進 解題的品質，使遺傳基因演算法在具多重績效的FMS排程應用更加穩健。 關鍵字 ： 彈性製造系統、排程、遺傳基因演算法、多目標

關鍵詞 : 彈性製造系統 ; 排程 ; 遺傳基因演算法 ; 多目標

目錄

參考文獻

1.雷邵辰，電腦整合製造(CIM)--CAD/CAM應用，松崗電腦圖書資料有限公司，民國八十一年。 2.許志義，多目標決策，五南圖書出版公司，民國八十二年。 3.蔡傳杰，"機械工業研究所彈性製造系統FMS整合技術發展歷程"，機械工業雜誌，八月號，pp138-145，民國八十五年。 4.尤威評，"模擬退法在彈性製造系統排程之應用"，大葉工學院碩士學位論文，民國八十五年。 5.楊宗銘，"遺傳基因演算法在多途程問題之探討"，中原大學碩士論文，民國八十四年。 6.徐俊能，"以遺傳基因演算法則解決多目標考量的推銷員旅行問題之研究"，大葉工學院碩士論文，民國八十三年。 7.蔡世鵬，"應用基因遺傳法於微波濾波器之最佳化設計"，碩士論文，民國八十五年。 8.林秀璘，"應用模糊多目標歸劃法於公車營運計畫之研究"，碩士論文，民國八十二年。 9.張忠樸，"實驗計畫速學活用法"，電路板資訊雜誌，民國八十三。 10.斐文，"加權模糊線性規劃法在多目標運輸問題上的運用"，中華民國工業工程學會84年論文集，pp370-377，民國八十四年。 11.張有恆，沈進成，"高速鐵路系統最適營運計畫之研究－運用模糊多目標規劃法"，運輸計畫季刊，第二十四卷 第四期，pp369-290，民國八十四年。 12.汪培庄，"模糊集合及其應用"，中國生產力中心，民國七十九年初版。 13.孫宗瀛、楊英魁，"Fuzzy控制:理論、實作與應用"，全華科技圖書股份有限公司，民國八十三年。 14.林我聰，"現場排程專家系統"，資訊與電腦出版社，民國八十三年。 15.Austin,S.," An Introduction to Genetic Algorithms", AI Expert, Mar.,pp49-53,1990. 16.Aanen,E.,Gaalman, G.J. and Nawijn, W.M, "A Scheduling Approach for A Flexible Manufacturing System", Inc.J.Prod.Res., Vol.31, No.10,pp2369-2385,1993. 17.Biegel,John E. and Davern, James J.,"Genetic Algorithms and Job Shop Scheduling", Computers ind.Eng.,Vol 19,Nos 1-4,pp81-91,1990. 18.Bramlette,M.F.,"Initialisation,Mutation and Selection and Selection Methods in Genetic Algorithm for Function Optimisation", Proceeding of the Forth International Conf. on Genetic Algorithms,pp100-107,1991. 19.Bit,A.K.,Biswal,M.P.and Alam S.S.,"Fuzzy Programming Approach to Multiple-criteria Decision Making Transportation Problem", Fuzzy Sets and systems, Vol.50, pp135-141,1992. 20.Chen, Chuen-Lung, Vempati, Venkateswara S. and Nasser, Aljaber,"An Application of Genetic Algorithms for Flow Shop Problems", European Journal of Operational Research,80,pp389-396,1995. 21.Chandra,J.and Talavage,J.,"Intelligent Dispatching for Flexible Manufacturing System", Int.J.Pro.Res.,Vol.29,No.11,pp2259-2278,1991. 22.Chen,Injazz J. and Chung, Chen-Hua,"Effects of Loading and Routing Decisions on Performance of Flexible Manufacturing Systems", Int.J.Prod.Res.,Vol 29, No.11,pp2209-2225,1991. 23.Dagli,Cihan and Sinchai,Sittisathanchai," Genetic Neuro-Scheduler for Job Shop Scheduling", Computers and Industrial Engineering,Vol.25,Nos 1-4,pp267-270,1993. 24.Davis,Lawrence,"Job Shop Scheduling with Genetic Algorithms",Proc. of 1st Int.Conf.on Genetic Algorithms and their Applications,pp 136-140,1987. 25.Falkenaurer,E. and Bouffouix, S., "A Genetic Algorithms for Job Shop Scheduling", Proceedings of the 1991 IEEE International Conference on Robtics and Automation Sacramento, April,pp824-829,1991. 26.Grefenstette, John J.,"Optimization of Control Parameters for Genetic Algorithms", IEEE Trans. on Sys. Man, and Cyber,Vol.Smc16,No 1, Jan/Feb,pp122-128,1986. 27.Gupta,Y.P.,Cupta,M.C.and Bector,C.R.,"A Review of Scheduling Rule in FMS", Int.J. Computer Integrated Manufacturing,Vol.2, No.6,pp356-377,1989. 28.Goldberg,D.E.,"Genetic Algorithms in Search,Optimization,and Machine Learning", Adision-Wesley Publishing Company,1989. 29.Holland,J.H.,"Adaptation in Nature and Artificial Systems",MIT Press,1975. 30.Hou,Edwin S.H., Nirwan, Ansari and Hong,Ren,"A Genetic Algorithms for Multiprocessor Scheduling",IEEE Transaction on Parallel and Distributed System,Vo 15, No 2, February,pp113-120,1994. 31.Hou,Edwin S.H. and Li,Hung-Yuan,"Task Scheduling for Flexible Manufacturing Systems Based on Genetic Algorithms", IEEE International Conference on System, Man and Cybernetics,pp397-402,1991. 32.Hutchison,J.,"Current and Future, Issues Concerning FMS Scheduling", OMEGA Int.J.of Mgmt Sci, Vol.19,No.6,pp529-537,1991. 33.Hutchison,Jim,Leong,Keong,Snyder,David and Ward,Peter,"Scheduling Approaches for Random Job Shop Flexible Manufacturing Systems",International Journal of Pro.Res.,Vol.29,No.5,pp1053-1067,1991. 34.Herrmann,Frank,Klaus,Muller and Sebastian,Engell,"FMS Scheduling Using Branch and Bound with Heuristics",Pro.of the 31st Conf. on Decision and Control,pp409-410,1992. 35.Hannan,E.L.,"Linear Programming with Multiple Goals", Fuzzy Sets and Systems,6,pp235-248,1981. 36.Hsu,G.J.Y. and Y.R. Tzeng,"A new Algorithm of Fuzzy Multiobjective Programming: The Compromise Factor Approach",Pro. The First International Symposium on Uncertainty Modeling and Analysis, Maryland University, Maryland,Dec.3-5,1990. 37.Iwata,K.Murotsu A. and Oba,F.,"Production Scheduling of Flexible Manufacturing Systems", Annals of CIRP, Vol.31,pp319-322,1982. 38.Jiang,J.and Hsiao,W.C.,"Mathematical Programming for the Scheduling Problem with Alternative Process Plans in FMS",Computers Ind. Eng., Vol.27,Nos1-4,pp15-18,1994. 39.Janikow,C.Z.and Michalewic, Z.,"An Experimental Comparison Binary and Floating Point Representations in Genetic Algorithms", Proceeding of the Forth International Conference on Genetic Algorithms,pp31-36,1991. 40.Kim,Yeo Keun, Kim,Young Ju and Kim,Yeongho,"Genetic Algorithms for Assembly Line Balancing with Various Objectives", Computers and Industrial Engineering, Vol.30,No 3,pp397-409,1996. 41.Lee,S.M. and Jung,H.J.,"A Multi-Objective Production Planning Model in a Flexible Manufacturing Environment", International Journal of Production Research,Vol.27,No.11,pp1981-1992,1989. 42.Lee,Doo Yong and DiCesare, Frank,"FMS Scheduling Using Petri Nets and Heuristic Search",Pro. of the 1992 IEEE Int.Conf.on Robotics and Automation,May,pp1057-1062,1992. 43.Liepins,G.E.and Hilliard,M.R.,"Genetic Algorithms:Foundations and Applications",Annals of Operations Research,21,pp31-58,1989. 44.Leibenstein,H.,"On Finding Compromise solutions in Multicriteria Problems Using The Fuzzy Min-Operator", Fuzzy Sets and Systems,6,pp105-118,1981. 45.Muller,H.,Samblanckx S.D. and Matthys,D.,"The Expert Scheduling Production Systems", International Journal of Production Research,Vol.25, No.11,pp1659-1670,1987. 46.Moser, Manfred and Engell, Sebastian,"A Survey of Priority Rules for FMS Scheduling and Their Performance for the Benchmark Problem", Proceedings of the 31st Conference on Decision and Control,December,pp392-397,1992. 47.Mukhopadhyay,S.K., Bibekananda, Mait and Sandip, Garg," Heuristic Solution to the Scheduling Problems in Flexible Manufacturing

System", Int. J.Pro.Res.,Vol.29,No.10,pp2003-2024,1991. 48.Murata,Tadahiko and Hisao, Ishibuchi,"Performance Evaluation of Genetic Algorithm for Flow shop Scheduling Problem", IEEE Trans. on Eng. Management,Vol.22,Iss 2,pp812-817,1994. 49.Oliver,I.M.,Smith,D.J.and Holland,J.R.C.,"A Study of Permutation Crossover Operators on the Traveling Salesman Problem",Pro. of the Second Int. Conf.on Genetic Algorithms and their Applications,pp224-230,1987. 50.Paulli,Jan,"A Hierarchical Approach for the FMS Scheduling Problem",European Journal of Operational Research, 86, pp32-42,1995. 51.Stecke,Kathryn E.and Narayan,Raman,"FMS Planning Decisions,Operating Flexibilities, and System Performance",IEEE Transaction on Engineering Management,Vol.42,No 1,February,pp82-89,1995. 52.Sauve,B.and Collinot,A.,"An Expert System for Scheduling in a Flexible Manufacturing System", International Journal of Production Research,Vol.3,No.2,pp229-233,1987. 53.Sridhar,Jagabandhu and Rajendran, Chandrasekharan," A Genetic Algorithms for Family and Job Scheduling in a Flowline-Based Manufacturing Cell", Computers and Industrial Engineering,Vol.27,Nos 1-4,pp469-472,1994. 54.Shaw,Michael J.,"Knowledge-based Scheduling in Flexible Manufacturing Systems: An Integration of Pattern-Directed Inference and Heuristic Search",Int.J.Prod.Res.,Vol.26,No 5,pp821-844,1988. 55.Shang,Y.and Li,G.J.,"New Crossover Operators in Genetic Algorithms", Proc.of The 1991 IEEE Int.Conf.On Tools For AI,pp150-153,1991. 56.Stoeva,Stefka,P.,"A Due Date-Based Dispatching Rule for Flexible Manufacturing Systems",Int.J.Prod.Res.,Vol.28,No.11,pp1991-1999,1990. 57.Sakawa,M.and T.Yumine,"Interactive Fuzzy Decision Making for Multiobjective Linear Functional Programming Problems",Large Scale Systems,Vol.5,No.2,pp105-113,1984. 58.Venugopal,V.and Narendran,T.T.,"A Genetic Algorithms Approach to The Machine-Component Grouping Problem with Multipe Obiectives", Computers and Industrial Engineering ,Vol 22,No.4,pp469-480,1992. 59.Wang,M.J.and Liang,M.,"Personal Selection Using Fuzzy MCDM Algorithms",European Journal of Operational Research,78,1994. 60.Zadeh,L.A.,"Optimality and Nonscalar-Valued Performance Criteria",IEEE Transactions on Automatic Control,Vol.AC-8, 1,1963,pp159-170. 61.Zimmermann,H.J.,"Fuzzy Programming and Linear Programming with Several Objective Functions",Fuzzy Sets and Systems,Vol.1, No.1,1978,pp45-56.