A Tolerance Allocation Optimization Design for Product Components－Using Particle Swarm Algorithm

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ABSTRACT

A product has to be accomplished through the procedure of design and manufacture. Designer usually makes dimensions tolerance by rule of thumb while their designing. Thus it would be un-coordinated between design and manufacture, and further takes cost lose. Therefore, tolerance Allocation system assistance for designer is necessary. In the paper could combine academic with reality, I got the exact tolerance cost material from processed industry factory for machines and tools. The study is used Grass-Newton method to fit cost curve equations of part in machine and combine optimal cost equations to become total cost in optimal problem. In the paper is used the Particle Swarm optimization algorithm and global minmization procedure to integrate tolerance allocation analysis module in minimum cost problem. In the minimum cost design, the design variables are obtained as corresponding the optimal solution of an objective function subjected to the side constraints via a constrained multi-start global optimization method. In addition, initiating optimization probability formula is increate the effect stability of analysis module. Finally, using Matlab software interface design function to program core into the interface to upgrade my research which designs not only practicability but also simple and easy to used operation of tolerance allocation analysis module.

Keywords : Tolerance Allocation、Tolerance Cost、Gauss-Newton Method、 Fitting Equation 、Particle Swarm Optimization Algorithm 、 Global Minmization Procedure

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REFERENCES

中文部分 [1] 王志炘, （民92）, 應用無限制點演算法於電力輸送損失最小 值的經濟調度, 碩士論文, 逢甲大學自動控制工程學系。
[2] 朱鳳傳, （民74）, 選用「公差」的基本觀念, 工業職業教 育, 5(1), 34-38。
[3] 林俊傑, （民87）, 裝配公差配置最佳化研究, 碩士論文, 交 通大學機械工程學系。
[4] 洪維恩, （民94）, Matlab 7 程式設計, 旗標出版股份有限公 司。
[5] 陳紘煒, （民93）, 複合材料殼構件力學行為分析與最佳化設 計, 碩士論文, 大葉大學工業工程與科技管理學系。
[6] 陳慶逸, （民94）, 粒子群演算法為基礎的演化式學習-系統設 計及其應用, 博士論文, 淡江大學電機工程學系。
[7] 陳正斌, （民94）, 基因演算法在公差分析上的應用, 碩士論 文, 大葉大學機械工程學系。
[8] 蔡碧紋, （民82）, 多目標公差配置之研究, 碩士論文, 交通 大學工業工程學系。
[9] 劉應興, （民87）, 非線性迴歸與相關分析應用線性迴歸模型－ 補編, 華泰書局。
[10] 劉大銘、洪桓祥, （民91）, 機械件裝配特徵的公差分析, 中 國機械工程師學會第二十屆學術研討會論文集（故力與設 計）。
[11] 劉清祥, （民94）, 粒子群演算法於結構設計及零工式排成之 應用, 碩士論文, 台灣國立海洋大學系統工程暨造船學系。
[12] 鄭國銘、蔡志成, （民91）, 應用Lagrange Multipliers 進行最 佳化公差配置, 中國機械工程師學會第二十屆學術研討會論 文集（固

力與設計）。
[13] 鄧永亟，（民93），利用PSO演算法探討高速銑削最佳化，碩 士論文，大同大學機械工程學系。
[14] 蕭志峰，（民91），具尺寸公差之方形工件最低成本製程規劃 設計，碩士論文，中興大學機械工程學系。 英文部分 [15] Chin-Young Lin, Wei-Hsin Huang, Ming-Chang Jeng and Ji-Liang Doong, (1997), Study of an assembly tolerance allocation model based on Monte Carlo simulation, Journal of Materials Processing Technology, 70, 9-16.
[16] Dong Z. and Hu W. and Xue D., (1994), New Production Cost-Tolerance Models for Tolerance Synthesis. J. Engineering for Industry, 116, 199-206.
[17] Homaifar, A. and McCormick, E., (1995),Simultaneous Design of Membership Functions and Rule Sets for Fuzzy Controllers Using Genetic Algorithms ,IEEE Transactions on Fuzzy Systems, 3, 2, 129-139.
[18] Kennedy J. and Eberhart R.C., (1995), Particle swarm optimization, Proceedings IEEE Int ’ l. Conf. on Neural Networks, 4, 1942-1948.
[19] Kennedy J. and Eberhart R.C., (1995), Particle Swarm Optimization, In proceedings of IEEE International Conference of Neural Networks, 4, 1942-1948.
[20] Kennedy J. and Eberhart R.C., (1997), A discrete binary version of the particle swarm algorithm, Proceedings IEEE Int ’ l. Conf. on Systems, Man, and Cybernetics, 4104-4108.
[21] Kutner M.H., Nachtsheim C.J., Neter J. and Li W., (2005), Applied Linear Statistical Models 5th ed , New York: McGraw-Hill.
[22] M. Clerc and J. Kennedy, (2002), The particle swarm explosion, stability, and convergence in a multidimensional complex space, IEEE Transaction on Evolutionary Computation, 6, 58-73.
[23] Ostwald P.F. and Huang J., (1977), A method for optimal tolerance selection, Journal of Engineering for Industry, ASME, 99, 558-565.
[24] Parkinson D.B., (1985), Assessment and optimization of dimensional tolerances, Computer Aided Design, 17, 191-199.
[25] Parsopoulos K.E. and Vrahatis M.N., (2002), Recent approaches to global optimization problems through particle swarm optimization, Natural Computing, 1, 235-306.
[26] Spotts M.F., (1973), Allocation of Tolerances to minimize cost of assembly. Journal of Engineering for Industry, ASME, 95, 762-764.
[27] Sutherland G.H. and Roth B., (1975), Mechanism design: accounting for manufacturing tolerance and cost in function generating problems, Journal of Engineering for Industry, ASME, 97, 283-286.
[28] Snyman J.A. and Fatti L.P., (1987), A multi-start global minimization algorithm with dynamic search trajectories. J. of Optimization Theory and Applications, 54(1), 121 41.
[29] Salman A., Ahmad I., and Al-Madani S., (2002), Particle swarm optimization for task assignment problem, Microprocessors and Microsystems, 26, 363-371.
[30] Shigenori N., Takamu G., Toshiku Y., and Yoshikazu F., (2003), A hybrid particle swarm optimization for distribution state estimation, IEEE Transaction on Power Systems, 18, 60-68.
[31] Trelea I.C., (2003), The particle swarm optimization algorithm: convergence analysis and parameter selection, Information Processing Letters, 85, 317-325.
[32] Ta-Cheng Chena and Gary W. Fischerb, (2000), A GA-based search method for the tolerance allocation problem, Artificial Intelligence in Engineering, 14, 133 – 141 [33] Yoshida H., Kawata K., Fukuyama Y. and Nakanishi Y., (1999), A particle swarm optimization for reactive power and voltage control considering voltage stability, Proceedings Int ’ l. Conf. on Intelligent System Application to Power Systems, 117-121.
[34] Zhang H.C., (1997), Advanced Tolerancing Techniques.