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信息科学

改进遗传算法与拟随机序列结合评定自由曲线轮廓度误差

温秀兰, 赵艺兵, 王东霞, 朱晓春, 曹未丰

南京工程学院 自动化学院, 江苏 南京 211167

摘要： 为了高效率、高精度检测自由曲线和曲面零件并计算轮廓度误差,提出将改进遗传算法与拟随机序列结合来评定自由曲线轮廓度误差。首先,针对自由曲线因没有已知的解析表达式而常用离散点表示其轮廓的特点,采用非均匀有理B样条(NURBS)来表示自由曲线,并用改进遗传算法优化重建自由曲线;然后,应用拟随机Halton序列均匀产生参数值精确计算点到曲线最短距离。阐述了自由曲线重建时控制顶点及目标函数值的计算方法,确立了改进遗传算法重建自由曲线及采用拟随机序列生成参数值求解点到曲线最短距离的具体步骤。最后,针对仿真实例计算并实测零件曲线轮廓度误差。结果显示,自由曲线轮廓度误差评定精度高于99%,表明提出的方法算法简单、计算速度快、精度高,适于在工程计量中推广应用。

关键词： 自由曲线 轮廓度误差 改进遗传算法 拟随机序列

Evaluating freeform curve profile error based on improved genetic algorithm and quasi random sequence

WEN Xiu-lan, ZHAO Yi-bing, WANG Dong-xia, ZHU Xiao-chun, CAO Wei-feng

Automation Department, Nanjing Institute of Technology, Nanjing 211167, China

Abstract: An evaluating method of freeform curve profile errors based on the Improved Genetic Algorithm(IGA) and quasi random sequence was proposed to inspect freeform curves and surface parts and to compute their profile errors efficiently and precisely. Firstly, according to the characteristics that the freeform curve was expressed by discrete points rather than an analytic function, the Non-uniform Rational B-spline (NURBS) was used to express the free curve and the IGA was proposed to reconstruct it. Then,the quasi random sequence was taken to generate parameter values uniformly and to calculate the shortest distance from a point to a reconstructed curve exactly.Furthermore, The computation methods of the control vertex and objective function value were described when freeform curve was reconstructed and the detailed steps were established for reconstructing the free curve and computing the shortest distance from the point to the curve based on the IGA and quasi random sequence. Finally, the curve profile errors of a simulation example and practical parts were calculated and measured. The results verify that the evaluation precision of freeform curve profile error is higher than 99%. The proposed method has the advantages of simple algorithm, rapid computation and high accuracy and it can be applied in engineering metrology.

Keywords: freeform curve profile error Improved Genetic Algorithm(IGA) quasi random sequence

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通讯作者: 温秀兰 (1966-), 女,内蒙古丰镇人,教授,2001年于东南大学获得博士学位,现为南京工程学院自动化学院副院长,主要研究方向为智能计算、逆向工程、精密计量技术。E-mail:zdhxwxl@njit.edu.cn

作者简介: 赵艺兵 (1966-),男,内蒙古呼和浩特人,高级实验师,1988年于太原理工大学获得学士学位,主要从事数控技术、逆向工程方面的研究。E-mail:zdhxzyb@njit.edu.cn
作者Email: zdhxwxl@njit.edu.cn

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