The Study of Microscale Forming Effect on Simulated Annealing Genetic Algorithm

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Abstract. The reason of micro forming of sheet is concluded. Using simulated annealing genetic algorithm does a kind of nonlinear optimization to reason of micro forming of sheet control. The diagnosis knowledge warehouse and controlling parameter of micro forming of sheet is built. It greatly improves the method of convergence on using the adaptive stretch. A diagnosis of simulated annealing genetic algorithm is constructed. At last, analyze of testing best result is given. Metal micro forming is microscale effect in the process of classification and evaluation, for the correct understanding of micro forming and conventional forming difference, it is guiding significance in the course of micro forming technology similar to conventional forming which is applied to the data and experience. The microscale effect is beneficial to accurate grasp of all kinds of microscale effect in the forming reasonable classification and evaluation.

1 Introduction

In the process of stamping production, research of the influence factors is lack of comprehensive evaluation. And influencing factors in the actual production is very complicated, for this kind of situation, it is necessary to develop factors influencing diagnosis expert system, but the defects of traditional diagnosis expert system is based on the symbolic operation, which needs to establish a knowledge base, reasoning rules can not meet the requirements for diagnosis in advance. Moreover, usually with many local minima point defect diagnosis problem, it tends to be small, discrete, multidimensional, conditional constraint and highly nonlinear problems. Accurately solving the global optimal solution is often very difficult. Then, it arises to based on simulated annealing genetic algorithm, the influence factors of minimum margin of deformation diagnosis technology is at the historic moment. Simulated annealing genetic algorithm SAGA is combining genetic algorithm and annealing algorithm, that is a new optimization algorithm. In general, the poor is local search ability of genetic algorithm, a better ability is to grasp the overall search process, and simulated annealing algorithm is to search the overall ability poorer, to grasp the strong local search ability[1]~[4]. Therefore, multi-objective combinatorial optimization problems is to solve, but combining genetic algorithm and simulated annealing algorithm, developed the excellent performance of high efficiency global search algorithm.

With the rise of micro/nano technology, the shape of tiny size and small size of operation for the characteristics of the fine is understanding and mastering the micro machining technology which become the world of new and high technology. The Industrialization of MST and MEMS greatly promotes microfabrication technology.,which is successively in ultra precision machining, deep reactive ion erosion profile control, molecular required by the assembly technology, etc. But the miniaturization industry requires mass, high efficiency, high precision, high density, short cycle, low cost, no pollution and net shaping ,which inherent characteristics restrict the extensive application of the fine machining technology.

2 The Diagnosis of Affecting Factors Based on Simulated Annealing Genetic Algorithm

Genetic algorithm is a generate detection search algorithm of the process, the search does not depend on gradient information, it especially suitable for processing of traditional search method, to solve complex nonlinear problems, and the factors affecting the minimum margin of diagnosing the problem is a nonlinear

problem, which cannot use traditional derivation method, the genetic algorithm can search the factors influencing the minimum margin of diagnosis in the automatic acquisition, and accumulation of adaptively controlling is the influence factors of minimum margin diagnosis of search process, and it can handle a large number of parallel, the factors is affecting the minimum margin of diagnostic information and strong robustness, this is to greatly improve the quality of the factors affecting the minimum margin of diagnosis, and processing speed has laid a theoretical basis.

Simulated annealing algorithm is due to the simple direct simulation of the process of solid annealing, to establish a universal stochastic search technology. Because it has many characteristics, such as robustness, robustness and efficiency, it has been successful in solving many combinatorial optimization problems. Simulated annealing genetic algorithm is combined genetic algorithm and simulated annealing algorithm, complement each other forms a new optimization algorithm, it is highly efficient global search ability, to solve the weakness of poor climbing ability of the genetic algorithm.

A combinatorial optimization problem is its objective function respectively, and it is solid microscopic energy equivalence. Made with the algorithm process of diminishing, the value of control parameter t bears the role of the process of solid annealing temperature, the value is for each control parameter t, algorithm is for generating data processing judgment to accept abandonment, the iterative process is corresponding to the solid at a constant temperature thermal of equilibrium state, respectively. T is to achieve the maximum value at the beginning, after enough to transfer, slowly decreasing t value, so it repeatedly meets a stopping criteria. Experiments is in the simulated annealing algorithm, to set initial temperature is 22, the end temperature is 0.25. In the simulated annealing algorithm with genetic algorithm, the selection operator is crossover operator, and mutation operator makes up the simulated annealing genetic algorithm.

3 The Development of Micro Forming Technology

3.1 All Aspects Spreaded to the Whole Process System Miniaturization. It is considered in the micro forming tool that die set meter, the optimization of process parameters, material wear and tear, and the problem of processing, but its main feature is the small caused ,size shall be decided in the microscale, in short, which is not the conventional scales of process parameters of several simply geometry, structure parameters, that is physical parameters to reduce the applied to the micro forming process. All aspects is spreaded to the whole process system miniaturization,. material party and the influence of the main table.Now the flow stress in the process of forming, anisotropy, forming limit and crystal materials of body scale and products relate the size: tiny structures to further spread to the influence of concrete material process,such as the forming force, friction and precision of the springback, burr and products are different with conventional scale , the micro forming process of friction lubrication conditions change, macroscopic in tribology friction theory control method is no longer applicable, the ratio of surface area and volume increase due to a microscopic scale bigger, the influence of friction on the forming is bigger than under macro dimensions, accordingly, lubrication has become a very important factors in the process, lubrication mechanism and macro situation is no longer the same. It also be considered in analysis of finite element program which was used to simulate these system in terms of tool and mould., namely how to make small size, high precision, complex inner cavity and inner hole, outer convex forming department.For forming equipment and transmission equipment is mainly forming transmission speed problem, such as micro blanking can achieve 300 times per minute of quick punch diameter less than 0.5 mm holes[5].

Micro bending force , deep drawing force of drawing process and blank-holder force, convex die fillet radius, the reasonable drawing gap, micro extrusion application of lubricant friction condition,which are not in accordance with the geometric proportion change, in the concrete process calculation, the process conditions of special effect is characterized by considering material intrinsic microscale effect are gaps with calculation results of actual values . As shown in Fig.1 , in the study for micro bending process, the calculation and

experiment measured is the difference of maximum of bending force F, geometric proportion coefficient under different friction coefficient is shown.
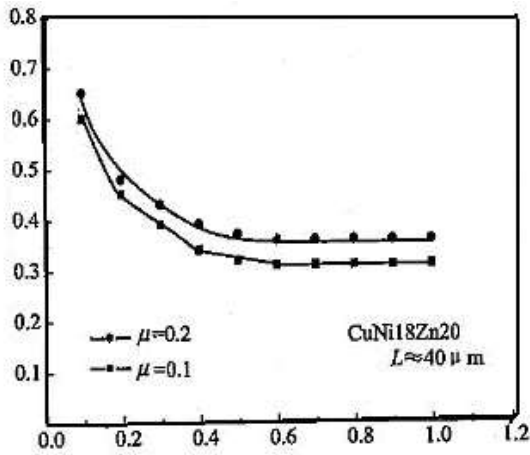

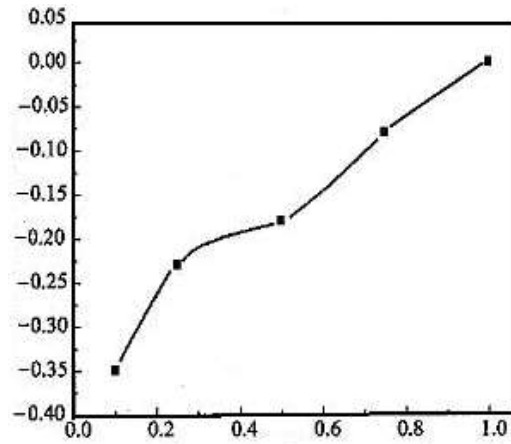Figure1. The calculation and experiment measured of bending force   Figure 2. The data for curve fitting

In Fig.1, there is a threshold value in lambda place,, and between 0.5-1, the actual value is lower than theory numerical value by 30%, this may be due to micro bending lower than test of micro tensile stress ratio of flow in the flow.T = 2 mm thickness of the material parameters is for the standard normal.

According to the result of the experiment data, the different geometric proportion specimen is similar to the difference and similarity of performance parameters, similar to the fine degrees respectively, according to the type calculation, the result as shown in Tab.1, because the yield point for macro eigen is unchanged ,parameters take k = 0.

The data for curve fitting as shown in Fig.2, geometric scaling of material yield point is low.Microscale effect of micro-scale is negative effects. And microscale effect is becoming more and more strong.as the negative effects of the geometric proportion narrow .The change trend is becoming more and more strong.

3.2 The Process Conditions of Microscale Effect Similar Accuracy. The process conditions of microscale effect mainly reflected in the quality of products.Morphology is related special effects and process conditions (including load, geometry boundary, etc.) , there are two aspects of special changes in micro scale, which can still be used for specific microscale effect similar to evaluate quantitative difference and similar precision, as blanking process is used a special manifestation of the cutting force, for example.

Material: CuZnl5; grain size: 54 um; Standard routine test, the thickness of blank s 1mm, the punch straight diameter 20 mm, clearance 0.1 mm; Then according to the geometric proportion coefficient in narrow, the experimental results is collected data, different geometry experiment is used by the cutting force of similarity, the results as shown in Tab.1, because the cutting force is used for technological conditions and formula of geometrical quantity is 2 times.

Tab.1 The cutting force of similarity

Thickness	Force	Ratio	similarity	gap	precision
1.0	13.80	1.0	1	0	0
0.8	11.1	0.80	0.804	0.164	0.256
0.5	7.00	0.50	0.507	0.257	1.08
0.2	3.00	0.20	0.217	0.177	4.425
0.1	1.56	0.10	0.113	0.103	10.3

RFI technology is a kind of resin membrane fusion and fibre prefabricated body with the combination of a resin impregnation technology. Its forming process is a resin preparation into resin film or thickens resin pieces and placed in the bottom of the mold, the upper cover is with suture or methods of 3d braided fiber made of prefabricated body. On the basis of vacuum forming technology, it will be the main points of the cavity encapsulation, thermal environment is used vacuum technology to resin by sucking up. Resin membrane after heated viscosity decreased, along the precast body climb from the bottom up, thus filling the whole precast body space, then according to the solidification process, parts made from composite materials. The technology is due to the traditional method of vacuum bag forming, freeing the RTM process for resin metering equipment and double injection mold processing, at the same time of creating excellent products, it greatly reduces the cost of the products. At present in the field of aviation is mainly used in the aircraft radome. But the process doesn't use autoclave curing parts, but also need to vacuum bag system and process requirement for high temperature, so the required core materials and tooling can withstand high temperature. The technology includes the key technology of: preliminary shape stamping (3d woven and suture techniques), resin flow simulation and control, weaving and sewing equipment research.

4 Conclusions

The reason of micro forming of sheet is concluded. Using simulated annealing genetic algorithm does a kind of nonlinear optimization to reason of micro forming of sheet control. The diagnosis knowledge warehouse and controlling parameter of micro forming of sheet is built. It greatly improves the method of convergence on using the adaptive stretch. A diagnosis of simulated annealing genetic algorithm is constructed. At last, analyze of testing best result is given. Metal micro forming is microscale effect in the process of classification and evaluation, for the correct understanding of micro forming and conventional forming difference, it is guiding significance in the course of micro forming technology similar to conventional forming which is applied to the data and experience. The microscale effect is beneficial to accurate grasp of all kinds of microscale effect in the forming reasonable classification and evaluation.

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