Machining Fixture Layout Optimization Using Symbiotic Organisms Search Algorithm

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Abstract

Machining fixtures are often availed to hold the workpiece when conducting operation in machining. Apparatus design involves finding part fasteners and clamps, for example. To ensure that the workpiece is prepared according to the specified resistances and dimensions then it has to be located and clamped appropriately. Reducing distortion of the workpiece due to the strengths of clipping, cutting is fundamental to maintaining for precision of machining. A perfect configuration of the apparatus displays minimal deformation during machining. This research was conducted to find the appropriate mounting to reduce the distortion of the piece's elasticity induced by the attachment and machining forces that follow the component during machining. This is done by choosing the best position for the perfect number of mounting components. The basic 3-2-1 layout varies for finding the location of fixture element is optimum in the position of locator and also clamp. The corresponding moment values are then formulated by the Symbiotic Organisms Search Algorithm (SOSA) In SOS objective function is formulated for minimizing moment. The optimal configuration of the fastening elements is the location that gives minimal time. Then MAT-LAB has deformation of the workpiece for optimal design.

Keywords: Fixture layout, Machining force, Clamping force, Symbiotic Organisms Search Algorithm, Harmonic analysis.
1. INTRODUCTION

Machining instruments are an precision tool to locate and inform the workpiece and machining. This dissertation focuses on machining equipment. The machining system is used to mount and maintain the necessary positioning and installation for part cutting. It is a crucial component in the process since it affects the organizational well-being and quality of components directly. A typical workplace is a base plate and several locators and clips. Locators are latent unit components used to place the piece while clips are dynamic installation components that can be moved mechanically, pneumatically or violently to withstand the workpiece's external forces. Appliance plan is a method for setting up the workpiece Fixation contact by locating the clips and defining components with the intention of minimizing the versatile distortion of the workpiece.

A. Elements of Fixtures

1) Locators: A locator is usually a settled part of a system and is used to establish the location of a component in an apparatus by pushing the component to grow.

2) Clamps: To completely restrict the workpiece, a gadget is not mandatory to help gadgets and dances and apparatuses.

3) Fixture Body: The fixing body is the main auxiliary components of the system and maintains the spatial relationship between locators, clasps, bolsters and the machine unit that is to be prepared for the part.

4) Supports: It is required for the assurance of the area of the parts ought to good with the locators and clips.

B. Symbiotic Organisms Search Algorithm

Nowadays Symbiotic Organisms Search (SOS) algorithm is very promising development in the field of metaheuristic algorithms. The SOS algorithm 's existence driven philosophy is analogous to the interactive conduct of organisms. The relationship category describes the symbiotic relationship between two different species that benefit mutually from that relationships.

The relationship category describes the symbiotic between two different relationship species in which one benefits and another is actively harmed. The plasmodium parasite is linked to the anopheles mosquito between human hosts. Although the parasite thrives inside the human body and reproduces, the human host is malaria-affected and can die. Traditional customary methods and expert estimates today. The earlier has strip step and dependably produce a similar arrangement with a similar beginning worth. Conflictingly, present day insightful calculations, in view of some stochastic circulation, can't create similar arrangements under any conditions. These sorts of met heuristic strategies can exploit the helpful data from the entire populace. Consequently they have a higher likelihood of looking for the last agreeable arrangement.
2. Problem Formulation and Approach

In the appropriate design, the machining and clamping forces lead to more elastic deformation of the component if the elements of fixtures such as clamps and locators are not positioned with optimum position and size and shape of the workpiece will affects so this type of problem may be establish when upgrading with the few components. The problem is exposed in this work by selecting the ideal area of system components. The location of fixture elements varies with the simple 3-2-1 layout of the locating principle and the corresponding moment values are determined by using the Symbio carbon Search Algorithm (SOSA). To find the optimal layout of fixture elements. For the time being, the objective function will be formulated in SOSA. The best fitting configuration for the optimum placement of fixture components is then obtained on the basis of the moment values. The workpiece deformation is then determined by using ANSYS for the optimum mounting configuration.

1) Workpiece Geometry and Properties

An example for the layout of the fixture optimization problem discussed in this work is a case of a power improvement problem for the prismatic working unit shown in Figure 1 shown by Li and Melkote (1999).

![Fig.1. End milling path of a prismatic workpiece](image)

**Fig.1. End milling path of a prismatic workpiece**

Fig.1 displayed the characteristics and geometry of the workpiece. The workpiece material is 7075- T6 Aluminium with a Poisson ratio of 0,33 and 72 GPa with a Young modulus of 2795 kg / m3. The diagram is 127 mm by 127 mm by 38.1 mm. The cut-out at beginning (101.6 mm, 34,29 mm, 127 mm) and ending at (101.6 mm, 34.29 mm, 0 mm) is represented for the end of a 25.4 mm gap.

2) Simulation of Machining Operation

Table 1 displays the process parameters for the end milling operation. The working power is 1105.67 N (tangential), 442.1 N (radial) and 283.56 N (axial). The entire apparatus route is ruined in 5 stages and the powers of vital order are decided by the cutter process.
3) Fixture Design Plan

Figure 3 indicates the plan of attachment to which the workpiece is clamped during machining. The 3-2-1 locator system is modified to design the mount. This approach provides the highest rigidity, with minimal critical characteristics. A workpiece in 3D can be emphasized by seven focuses process, so that nine measures of workpiece flexibility can be used. The remaining three stability phases are replaced by brace materials. There are three snaps used to monitor the workpiece, as shown in Figure 3. The frequency of clamping is 738.5, 341.1N and 1026.8N.

![Fig.3. Workpiece-fixture configurations](image)

### 3. METHODOLOGY

The initial step of optimization is to have appropriate installation design arrangements that are necessary for preparation of the SOSA and the highest deformation of each apparatus type is discovered using MATLAB. SOSA defines the design area for all plan variables to minimize the deformation of the workpiece. After the enhancement phase, the possible new interface designs in the local framework can be identified, a second to predict the optimum deformation significance for each function design. The best fitting shows the least variance with the other fitting.
4. FIXTURE LAYOUT OPTIMIZATION

The initial step of optimization is to have appropriate installation design arrangements that are necessary for preparation of the SOSA and the highest deformation of each apparatus type is discovered using MATLAB. SOSA defines the design area for all plan variables to minimize the deformation of the workpiece. The possible new system designs in the location are identified after the phase of development and the maximum deformation is expected. Force of clamping such as Machining Force, Position of locators, clamps, Material of workpiece and Numbering of locators, clamps.

In this paper very low adjustment forces are used to stabilise the workpiece and the procedure for the machining is chosen for my study. The 3-2-1 mounting configuration is chosen. Since this approach offers the highest strength for the least number of fixed object components. Therefore, only by changing detector locations is the fixture arrangement strengthened to reduce the work component distortion. The configuration variables are therefore the location of the device and the clamp.

Six locators and two clamps for the workpiece are included in the apparatus configuration. Each aspect has three organisational values. The value would then be twenty-four. In all instances, a contradictory element in each element is always different. A further variable is often believed to be constant. The variables of design are
1. SOS Algorithm Process

SOS algorithm is one of the most promising recent metaheuristic algorithms. The essence of the SOSA algorithm's inspired philosophy is close to the interactive behavior of organisms. Organisms in the natural world rarely exist in isolation because their sustenance and survival relies on other animals. Organisms typically establish symbiotic relationships as a mechanism to adapt to environmental changes. Three quest cycles are conducted to emulate the three symbiotic relationship stages of so-called mutualism, commensalism, and parasitism.
The following instant values are obtained by using the SOS Algorithm to optimize the location of the fixture layouts.
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<th>L4</th>
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Fig.9 locators Positions and its corresponding minimum moment values
5. CONCLUSION

The optimization method to solve the problem of the installation design is discussed briefly in this section. The position of the fixture elements must be modified and the process repeated until a minimum time is reached by using the SOS Algorithm. A MATLAB software is used to build the SOS algorithm. This model works much like the normal iteration process.

References


