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Cultivator Sweep Tolerance Gauge

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Cultivator Sweep Tolerance Gauge

Problem Statement

USM Wear Technologies has a problem with the quality control of John Deere cultivator sweeps in both the 9" and 7" sweeps. They would like to implement a system into the process that will eliminate parts that do not meet tolerance before putting on their patented Caden Edge.

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TSM 416 Technology Capstone Project

Cultivator Sweep Tolerance Gauge

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1 PROBLEM STATEMENT

USM Wear Technologies has a problem with the quality control of John Deere cultivator sweeps in both the 9" and 7" sweeps. They would like to implement a system into the process that will eliminate parts that do not meet tolerance before putting on their patented Caden Edge.

Problem Statement

- o USM Wear Technologies is a supplier of tungsten carbide edge cultivator sweeps. These sweeps are ordered from manufacturers such as John Deere, then using a patented process, USM welds on a tungsten carbide edge that greatly reduces the wear of the sweep, which in turn provides better cultivation resulting in higher yields.
- o The problem in the process is that the robotic welding process must have a minimal thickness at the edge of the sweep where the carbide is applied. If the edge thickness is below minimum, it results in the weld burning through the parent material leaving no place for the carbide to be applied.

- o The minimal thickness is not known. Having a defective part will wear at the same rate as the non-carbide edge sweep, nullifying the edging process. The result is a loss of labor cost and material on producing a defective part. Also, the sweep fails the advertised lifespan.
- o Visual quality checks are performed at the beginning and end of the process, but no measurements are taken. Because the process is not standardized, defects still occur. The solution to the problem is to take accurate measurements of the cultivator sweep and compare those to the minimal thickness described in a new Standard Operating Procedure. These measurements have to be taken quickly and easily to not interfere with the process' existing cycle time.
 - A. USM Wear needs a measuring system that can quickly determine the thickness of the contact edges of the cultivator sweep.
 - B. Without accurately measuring the contact edges, bad sweeps are being processed and possible good sweeps are being rejected.
 - C. The operator at the beginning of the process does a quality check to determine if the edges meet the minimal thickness, but no exact measurement is taken. If a contact edge is too thin, but continues onto the process, the sweep will be defective. If the contact edge is above the minimum, but the operator still rejects the sweep, then good sweeps are being sent back to the supplier.
 - D. By providing a solution to this problem, USM can quickly and accurately measure the contact edges of the sweep and eliminate processing nonconforming sweeps as well as discarding good sweeps.
 - E. The CEO of USM Wear is very concerned with this issue. Producing defective parts is costly.

2 GOAL STATEMENT

- **Main Objective(s) and Specific Objectives**
 - o The main objective is to: design, build, and implement a go/no go gauge that will take the critical measurements of each cultivator sweep.
 - o Specific objectives include:
 - o (1) Design a gauge that will measure the thicknesses of the contact edges:
 - The design should allow for multiple types and sizes of cultivator sweeps.
 - The design should take accurate measurements of each sweep repeatedly.
 - The design should allow for future integration into a robotic cell.
 - The design must allow for ease of being built.
 - The design must take measurements quickly.
 - The design must take measurements easily.
 - o (2) Build a working prototype.
 - The prototype should be similar in design to the finished gauge.
 - The prototype should be able to accurately measure contact edges.
 - The prototype should provide proof-of-concept.
 - The prototype must be constructed at a low cost.
 - The prototype must function.
 - o (3) Build a finished go/ no go gauge.
 - The finished gauge should be easy to use.

- The finished gauge should be durable.
- The finished gauge must accurately take measurements.
- The finished gauge must allow for ease of integration.
- (4) Implement the finished go/ no go gauge.
 - Implementation should be simple.
 - Implementation should be quick.
 - The system will effectively measure the parts.
 - Implementation should allow for future use inside of a robotic cell.
- **Rationale**
 - Cultivator sweeps will be measured quickly and accurately while not dramatically affecting cycle time, while simultaneously reducing defective parts.
 - Example 1- A cultivator sweep with a contact edge that is too thin will not pass the go/ no go gauge.
 - Example 2- A cultivator sweep that is compliant will pass the go/no go gauge.

3 PROJECT PLAN/OUTLINE

A. Methods/Approach

- Reference Material(s)
 - USM Wear Tech SOP and specifications provided from USM Wear.
- Data collection:
 - The measurement data must be taken digitally to allow for future integration.
 - All data collection is made possible through an I/O link in the measurement system interface.
- Skills:
 - Determine this minimal thickness of the contact edge. Cp and Cpk data. Maximum allowable change in cycle after implementation.
 - Useful classes will be TSM 216, TSM 210, TSM 340, TSM 440, and TSM 465.
- Solutions:
 - The before and after evaluations will not be quantifiable because the current defect rate is unknown. The evaluation of the solution will be determined by the gauge's ability to meet the clients demands.
 - We will evaluate each solution through the use of a decision matrix.
- Organization:
 - To organize the steps of the project, we will use a timeline and a weekly report to visualize the process along with meeting weekly.

B. Results/Deliverables

- DPM reduction
- Cost analysis on defective parts
- Completion date is tentatively May 1st
- Milestones will follow our scheduling summary

4 BROADER OPPORTUNITY STATEMENT

- A. This project pertains to agricultural industry and manufacturing industry
 - o Our project helps with the production of longer lasting cultivator sweeps, which has multiple lasting effects on the environment
 - o Our client will benefit the most from our final design, which addresses his needs specifically
- B. Our project does not address needs or provide solutions to Big Challenges.
- C. Other industries with quality control issues that experience similar problems with part thickness.
- D. Industries that are involved with manufacturing and agriculture could use this application.
- E. Outside the scope of the project.
- F. Competitors aren't addressing tool life the same way that USM Wear Technologies is. Competitors are more concerned with quantity vs quality.

5 PROJECT SCOPE

- o We are only working on the John Deere cultivator sweeps
- o We have only the Spring semester to accomplish the implementation of our solution
- o The welding department, quality control department, outside contractors, and the CEO are included in the scope of this project
- o We will not be working with any other departments
- o The initial thought of using 3D scanning is outside of our boundaries, it would take too much time to implement effectively

6 GRAPHICAL ABSTRACT

