

MET-2160: 3D SCANNING, REVERSE ENGINEERING, AND QUALITY INSPECTION

Cuyahoga Community College

Viewing: MET-2160 : 3D Scanning, Reverse Engineering, and Quality Inspection

Board of Trustees:

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Academic Term:

Fall 2018

Subject Code

MET - Mech Eng/Manuf Ind Eng Tech

Course Number:

2160

Title:

3D Scanning, Reverse Engineering, and Quality Inspection

Catalog Description:

Covers the principles of engineering parts inspection and reverse engineering processes through the applications of 3D scanning, blueprint reading, hand tools measuring and Coordinate Measuring (CMM technologies.) Emphasis on performing laser scanning to generate 3D images; converting scanned images into 2D/3D models utilizing applicable software; employing CMM technologies for parts inspection and generating points cloud for 3D modeling; and interfacing generated models with reverse engineering methods.

Credit Hour(s):

3

Lecture Hour(s):

2

Lab Hour(s):

3

Requisites

Prerequisite and Corequisite

MET-2601 3D Solid Modeling

Outcomes

Course Outcome(s):

Apply the fundamentals of CMM and hand tools to analyze and inspect mechanical components.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):

1. Differentiate between contact and non-contact scanning methods with Laser / probe Arm Technology.
2. Perform part scanning or probing and create a new CAD part.
3. Explain how hand-held measuring devices function to ensure accurate data collection.

Course Outcome(s):

Apply the fundamentals of Laser Arm Scanning to mechanical components for the purposes of reverse engineering and production of engineering parts.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):

1. Explain the reverse engineering process.
2. Identify the software used in reverse engineering as interfaced with Laser Arm technology.

Course Outcome(s):

Apply quality systems, principles, concepts or industry standards and utilize appropriate math, measurement, data collection and statistical tools and technology.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):

1. Demonstrate the ability to read measurement tools.
2. Show the ability to correctly document data collected.
3. Demonstrate the ability to properly interpret engineering drawings.

Methods of Evaluation:

1. Lab reports, scan/probe for inspection, scan for reverse engineering
2. Quizzes
3. Technical Documents
4. Midterm examination
5. Final examination
6. Final Project

Course Content Outline:

1. CONCEPTS
 - a. CMM/ Scanner
 - b. Probe/ Laser Calibration
 - c. Part Set-Up
 - d. Location Measurements
 - e. Feature Measurements
 - f. Report Generation
 - g. Positioning tool
 - h. Operating elements
 - i. Errors
 - j. Causes
 - k. Corrective measures
 - l. Mesh Buildup
 - m. Auto Surfacing
 - n. Regions
 - o. Aligning
 - p. Caliper reading
 - q. Micrometer reading
 - r. Height gage reading
 - s. Quality system principles
 - t. Data collection and documentation
2. SKILLS
 - a. CMM/ Scanner
 - b. Identify the relationships in geometric figures
 - c. Demonstrate the use of Tolerance theory and applications
 - d. Demonstrate an understanding of Constructions, in points, lines, angles, distances, circles, and Planes.
 - e. Apply Support Tools and Features effectively to enable reverse engineering operations
 - f. Demonstrate an understanding of working with Motion Controls
 - g. Diagnose machine failures, identify service, and preventive maintenance requirements
 - h. Ability to use hand tools such as calipers, micrometers and height gages

- i. Ability to accurately document data collected
 - j. Ability to interpret drawings and proper dimensioning and tolerances
3. ISSUES
- a. CMM/ Scanner
 - b. Equipment sufficiency
 - c. Safety in Operation of CMM and Laser Arm Scanner
 - d. Interface with software program to convert to STL files

Resources

Hocken, Robert J. and Paulo H. Pereira, ed. *Coordinate Measuring Machines and Systems*. 2nd ed. Boca Raton: CRC Press Taylor Francis Group, 2012.

COORD3 Metrology. *Coordinate Measuring Machine History - Fifty Years of CMM History leading up to a Measuring Revolution*. 2013.

Geomagic Solutions. *DesignX*. 2016.

Resources Other

Instructor Handouts

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Key: 2912