“高教杯”全国大学生先进成图技术与产品信息建模创新大赛

“Higher Education Cup” National College Student Innovation Competition for Advanced Graphics Technology and Product Information Modeling

【高精度 3D 视觉数字化测量与建模赛道】

High-Precision 3D Vision Digital Measurement and Modeling Track

任务书（样题）

Task Specification (Sample)

时间：2小时（120分钟）Time Allowed: 2 hours (120 minutes)

提供数据：

此试题包含了下列数据/文件：

- 任务书
- 给定的实物零件
- 给定的数模及扫描数据
- 给定的逆向建模尺寸表、检测要求

Provided Materials

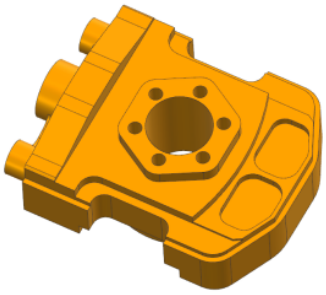
This task includes the following data/files:

① Task Specification

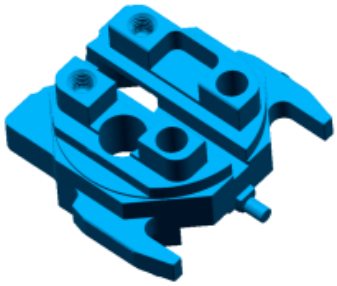
② Assigned physical part

③ Assigned CAD model and scanned data

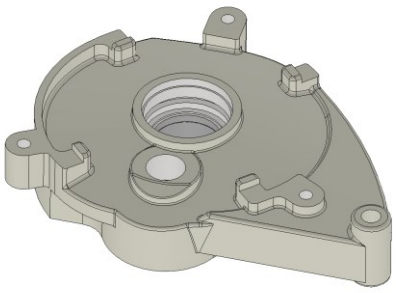
④ Assigned dimension table for reverse modeling and inspection requirement



Part1



Part2



Part3

项目描述 Project Description

在全球工业 4.0 与智能制造快速发展的背景下，数字化技术显著提升了产品设计的效率与精度，缩短了产品研发周期，并推动复杂结构设计的创新突破，为制造业转型升级提供了关键支持。

近日，公司正在使用高精度 3D 视觉技术研发产品。你所在的团队需要完成产品部分零件的三维数据采集、零件逆向建模、零件尺寸检测工作。请合理安排团队人员分工，完成相关工作。

Against the rapid advancement of Industry 4.0 and intelligent manufacturing worldwide, digital technologies have significantly improved the efficiency and precision of product design, shortened research and development cycles, and driven innovative breakthroughs in complex structural design, providing critical support for the transformation and upgrading of the manufacturing sector.

Recently, the company has been developing products using high-precision 3D vision technology.Your team is required to complete 3D data acquisition, reverse modeling, and dimensional inspection for selected product components.Please arrange the division of labor appropriately to fulfill the required tasks.

选手指示Contestant Instructions

任务一：三维数据采集 Task 1: 3D Data Acquisition

1. 按照以下要求，完成 Part1、Part3 的三维数据采集：
   - 扫描时间不超过20min（包含数据处理、保存、传输等）；
   - 点云数据不含任何网孔修复或人为创建的迹象；
   - 完成模型多边形化封装处理，并对封装多边形进行合理优化；
   - 标志点处不作评分，未扫描到的部分不能进行补缺；
   - 提交STL格式文件，按照零件名称命名；

1、Complete the 3D data acquisition for Part 1 and Part 3 in accordance with the following requirements:

① Scanning duration shall not exceed 20 minutes (including data processing, saving, and transfer).

② Point cloud data must show no evidence of hole filling or artificially created geometry.

③ Complete the polygonal meshing of the model and perform reasonable optimization of the meshed polygons.

④ Marker areas will not be scored; unscanned regions must not be filled or repaired.

⑤ Submit files in STL format, named according to the corresponding part name.

任务二：零件逆向建模 Task 2: Reverse Modeling of Parts

1. 使用提供的扫描数据，按照以下要求完成 Part1 的逆向建模工作：

- 在模型适当位置创建工作平面，并完成坐标系对齐（摆正）；
- 通过参数化建模和约束，完成Part1各部位结构特征的建模，保证尺寸精度；
- 测量精度为：±0.3 mm；
- 模型输出一份qsf格式工程文件和STP文件，按照零件名称命名；

2. 按照要求将逆向建模结果相关尺寸填写到尺寸表中；

1. Reverse Modeling for Part 1

① Using the provided scan data, complete the reverse modeling of Part 1 in accordance with the following requirements:

② Create a work plane at an appropriate position of the model and complete coordinate system alignment;Complete modeling of all structural features of Part 1 through parametric modeling and constraints to ensure dimensional accuracy;

③ Measurement tolerance: ±0.3 mm;

④ Output one engineering file in QSF format and one file in STP format, named according to the part name.

2. Fill in the relevant dimensions of the reverse modeling results into the dimension table as required.

任务三：零件尺寸检测 Task 3: Dimensional Inspection of Components

1. 使用提供的扫描数据，按照以下要求完成 Part2 的尺寸检测工作：

- 将Part2的扫描数据导入三维检测软件中；
- 根据要求，完成零件几何尺寸、几何公差的测量；
- 设置合适的相机视角和检测报告模板；
- 所有测量结果需按顺序在报告中体现；
- 输出一份SNIProj格式工程文件和PDF检测报告；

1. Using the provided scan data, perform the dimensional inspection of Part 2 in accordance with the following requirements:

① Import the scanned data of Part 2 into the 3D inspection software;

② Perform measurements of geometric dimensions and geometric tolerances as required;

③ Set up appropriate camera views and an inspection report template;

④ Ensure that all measurement results are presented sequentially in the report;

⑤ Export the project file in SNIProj format and the inspection report in PDF format.

2. 使用提供的扫描数据和数模，按照以下要求完成 Part3 的尺寸检测工作：

- 将给定的扫描数据和数模导入三维检测软件中；
- 使用正确的方式，将扫描数据与数模对齐；
- 根据要求，完成零件几何尺寸、几何公差的测量；
- 设置合适的相机视角和检测报告模板；
- 所有测量结果需按提供模板的样式在报告中体现；
- 输出一份SNIProj格式工程文件和PDF检测报告；

2. Using the provided scan data and CAD model, perform the dimensional inspection of Part 3 in accordance with the following requirements:

① Import the given scan data and CAD model into the 3D inspection software;

② Align the scan data with the CAD model using the correct method;

③ Perform measurements of geometric dimensions and geometric tolerances as required;

④ Set up appropriate camera views and an inspection report template;

⑤ Ensure that all measurement results are presented in the report following the style of the provided template;

⑥ Export the project file in SNIProj format and the inspection report in PDF format.

提交文件 Files to Be Submitted

全部数据均存放在个人文件夹内（文件夹命名：考号-高精度3D视觉测量与建模，如“05-高精度3D视觉测量与建模”）。

All data shall be stored in the personal folder (folder naming convention: [Examination Number] - High-Precision 3D Vision Measurement and Modeling, e.g., "05 - High-Precision 3D Vision Measurement and Modeling").

评分标准 Grading Criteria

部分 Section	内容 Task Content	评分点 Scoring Items	**分值** Points

1	三维数据采集 3D Data Acquisition	扫描数据完整性 Scan Data Completeness	28
		提交数据格式 Submission File Format	2
2	零件逆向建模 Reverse Modeling of Parts	逆向建模特征 Reverse Engineering Features	13
		建模尺寸精度 Modeling Dimensional Accuracy	13
		提交数据格式 Submission File Format	4
3	零件尺寸检测 Dimensional Inspection of Parts	检测尺寸精度 Inspection Dimensional Accuracy	10
		数据对齐 Data Alignment	3
		检测报告正确性 Inspection Report Accuracy	22
		提交数据格式 Submission File Format	5

合计： Total Points	**100**