Test Project (Offline)

BRICS-FS-04_Additive Manufacturing

2022 BRICS Skills Competition

Module A： 3D Data Collection& Reverse Modeling

Module B： Defect Repair

Module C： 3D Digital Inspection

Module D： Scheme Design

Module E： Internal Motion Mechanism Design of Product

Module F： Product Appearance Design

Module G： Product 3D Printing and Post-Processing

Duration： 420 Mins

Oct.2022

Statement

1. Participants shall abide by relevant rules and regulations and safety rules during the competition. In case of violation, corresponding points shall be deducted from the total score of the examination according to relevant regulations.

2. Each team shall pay attention to the reasonable allocation of time and complete all tasks within the specified competition time. At the end of the competition, all competitors must stop operation.

3. Please pay attention to saving the files in real time during the competition. Any problems such as computer "crash", "restart", "shutdown" and so on caused by improper operation of competitors shall be borne by themselves.

4. Any information or special marks related to the participants shall not appear on the submitted electronic documents, otherwise it will be deemed as cheating.

5. In case of malicious destruction of competition equipment or influence on others' competition, the competition qualification will be cancelled.

6. Participants should carefully read the contents and requirements of the assignment. If there is any objection during the competition, they can report it to the judges on the scene and should not disturb the order of the venue

7. All electronic documents shall be saved in a folder, named "additive manufacturing", and copied to the given two USB flash drives respectively. Finally, the participants shall put two USB flash drives and an envelope containing the password into the archive bag for sealing, and submit it to the on-site referee together with the assignment book.

Module A: 3D Data Collection& Reverse Modeling

Task 1: Job Description

The participants use the 3D scanner provided by the venue and the scanning piece of the car front bar bracket to complete the 3D scanning of all aspects of their appearance, and make corresponding choices for the obtained point cloud, remove noise and redundant point data processing, and use the computer and 3D design software provided by the venue to complete the reverse design of the collected data, so that it can restore its original geometric state.

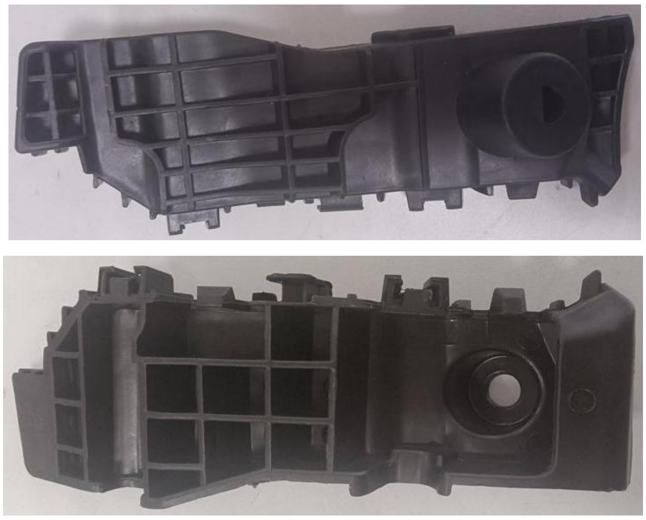


Figure 1 Car front bumper bracket

Task 2: Requirement

1. It is necessary to make preparations for digitization of parts. If necessary, please wipe away dust, impurities, etc.

2. Stick the mark points on the sample and connect the scanner.

3. Collect the 3D data of the sample, and restore the parts and equipment to the original state after scanning.

4. Create a parametric editable 3D model, and the function of automatically generating patches is prohibited.

5. The CAD model of digital analog reconstruction shall eliminate the original object defects caused in the process of production, operation, fault and maintenance (nick, flash, shrinkage, deformation, flow pattern, etc.), and restore the original geometric shape.

6. The measurement unit used for the model constructed by the contestant: mm - for linear

dimensions, degrees (°) - for angular dimensions.

Submittal: submit the electronic file of point cloud in. asc and. stl format after selection, and the file name is "SM"; The source file of 3D digital modeling electronic document and. xrl or. prt format file. The file name is "JM". Save to the "MA" folder.

The score criteria are distributed as follows：

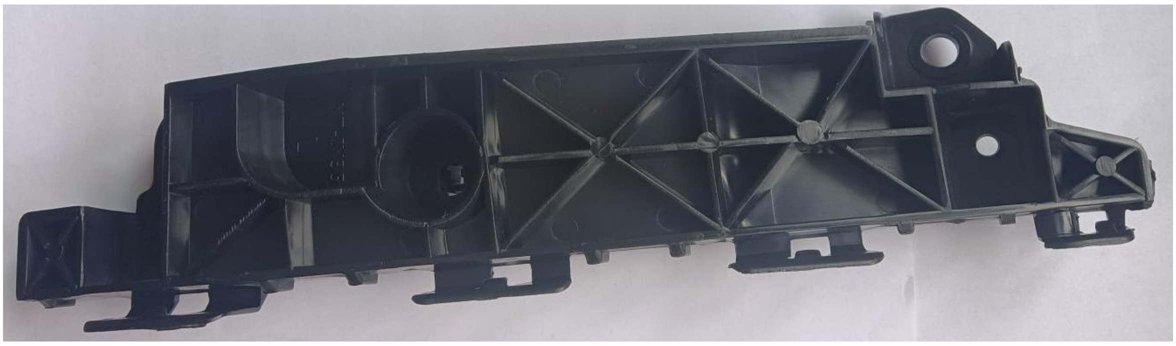
Index	Work site cleaning	Equipment usage	data processing	Surface quality	structure characteristics	Model size	file save
Score	1	1	2	3	4	3	1

Scoring points: use the equipment in a standard way, tidy up the work place, place the tools neatly, and align the coordinates; The features shall be complete; The data has no errors such as ripple, burr, displacement and dislocation; Complete modeling requirements for surface and structural details; The modeling dimension shall be controlled within ± 0.1; The part not scanned cannot be filled; No score will be given for overall fitting.

Module B defect repair

I, Task Description

According to the point cloud data of the damaged car front bar bracket, the participants conducted a three-dimensional digital modeling of the appearance of the car front bar bracket. During the modeling process, the damaged part was repaired to restore the design state. The damaged front bumper bracket is shown in Figure 2, and the damaged rear bumper bracket is shown in Figure 3.



Pphoto 2 Damaged front bumper bracket

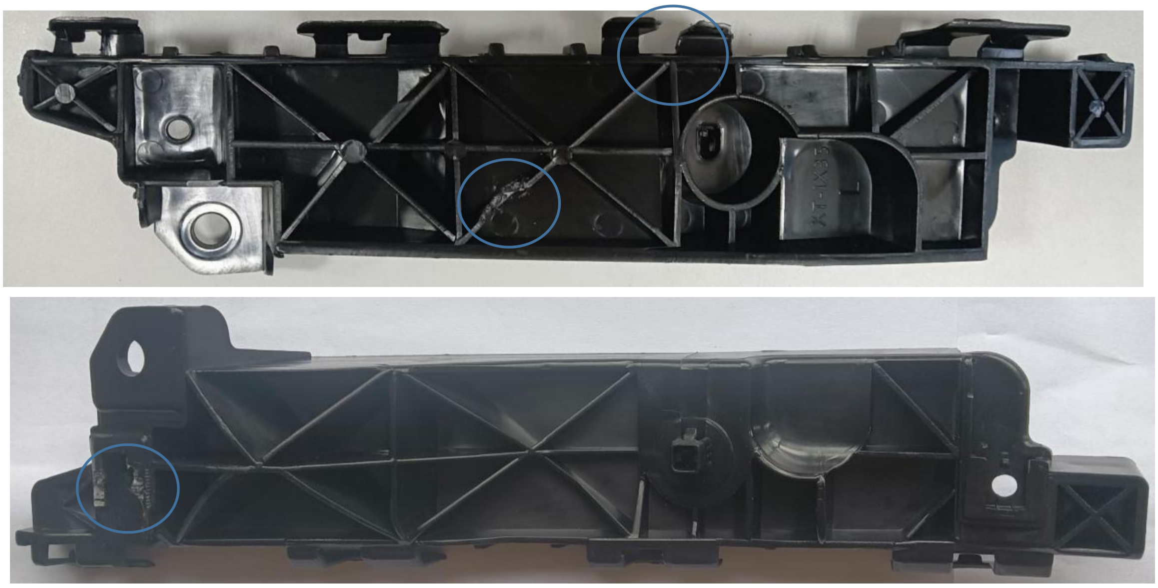


Photo 3 Damaged front bumper bracket

II. Task requirements

1. Align the coordinates of the given. stl polygon model.

2. Create a parametric editable 3D model, and disable the function of automatically generating patches.

3. In reverse modeling, repair the design status of the three damaged parts shown in Figure 3 to ensure that they are consistent with the original structure, and the structure of other parts cannot be changed. If the feature data is incomplete, design by yourself.

4. The CAD model of digital analog reconstruction shall eliminate the original object nick, flash, shrinkage, deformation, streamline, burn and other defects caused during production, operation, fault and maintenance, and restore the original geometric shape.

5. The measurement unit used for the model constructed by the contestant: mm - for linear dimensions, degrees (°) - for angular dimensions.

Submittal: submit a file in "stl" format after data processing of the damaged front bumper bracket, named "B-chuli"; The repaired digital model of the front bumper bracket is in the format of ". xrl" or ". prt". The file is named "B-xiufu". Save to the MB folder.

The score indicators are distributed as follows:

index	Polygon Model	Reverse modeling requirements	Reverse modeling features	Reverse modeling repair features	Reverse modeling dimension	Bulk deviation	file save
Score	1 one	1 one	4 four	5 five	2.5 two point five	0.5 zero point five	1 one

Scoring points: coordinate alignment, modeling is single, etc; The modeling features shall be complete; Reverse modeling repair feature repair is complete; The modeling dimension error shall be controlled within ± 0.1mm; The average volume deviation between polygonal model and reverse three-dimensional model shall be controlled within ± 0.1mm; Save the file path and name the file as required.

Module C 3D digital detection

I. Task Description

According to the STL file of the 3D scanning data of the sample provided by the competition field, the CAD digital model of the product and the PDF file of the part drawing, the participants conduct coordinate alignment, display the overall appearance deviation of the part, mark the maximum value of positive and negative errors on the section, test all the dimensions and geometric tolerances marked on the drawing, and issue the test report. The front and back surfaces of the sample are shown in Figure 5, and the part drawing is shown in Figure 6.

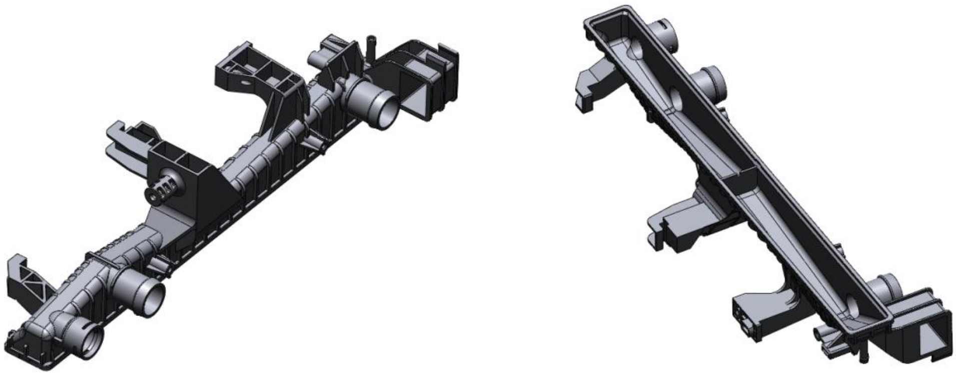


Figure 5 Front and Back Outline of Sample

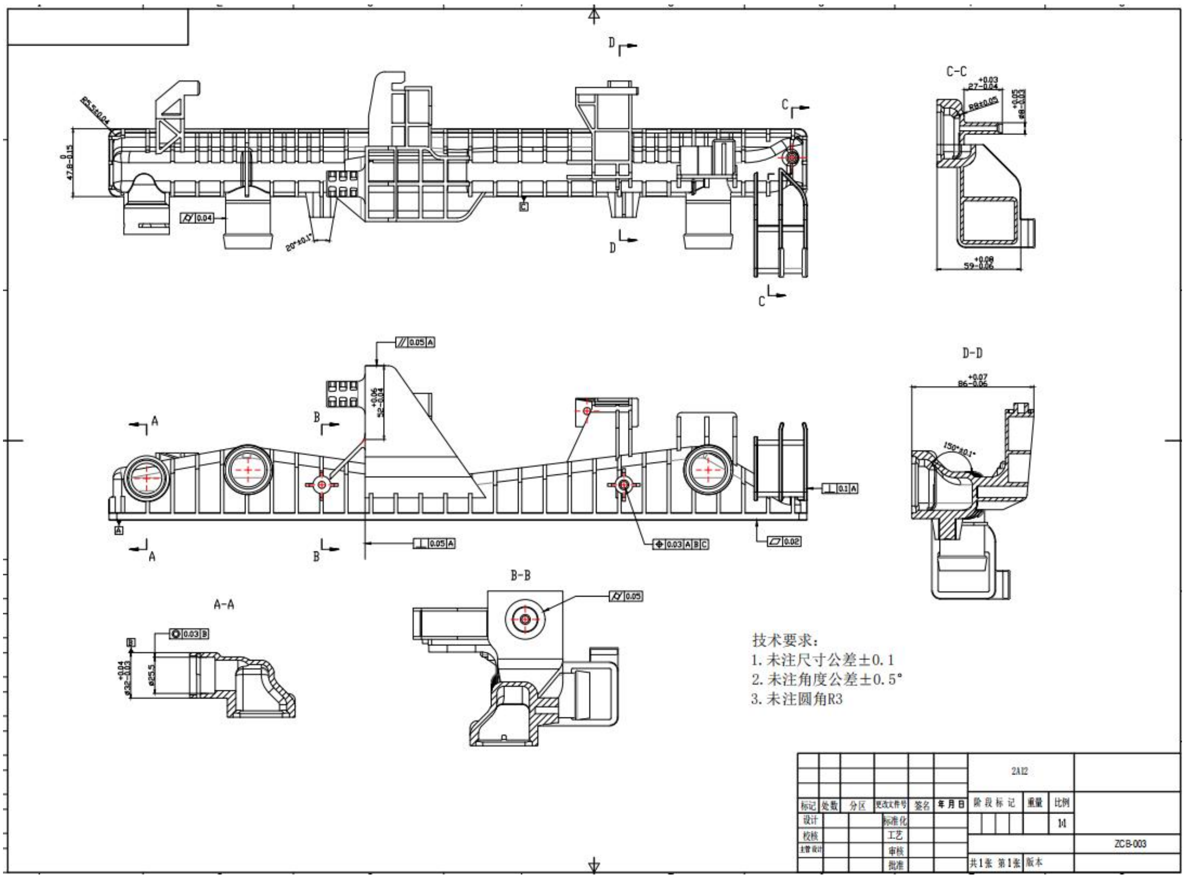


Figure 6 Sample Parts

II. Task requirements

1. According to the given polygon model of a part (3D scanning data STL file), the contestant completes the alignment of 3D scanning data and CAD data with datum A, datum B and datum C on the drawing as the alignment datum.

2. To complete 3D comparison, it is required to set a critical value of ± 0.5 and a tolerance of ± 0.15. Use point annotation to annotate the position where the average point error is greater than

0.2 within 1.5mm of one of the three planes. The overall appearance and deviation of the part are displayed completely, with at least four views.

3. Complete 2D comparative analysis of the section parallel to datum C and 8.9mm away (offset toward the center), mark the maximum positive and negative errors on the section, and name this view 2D Comparison Max&Min.

4. Complete the dimensional measurement with tolerance requirements in the drawing, and create 2D sections as required if necessary.

5. Complete the form and position tolerance measurement and evaluation of cylindricity, flatness, perpendicularity, parallelism, coaxiality and position in the drawing.

6. All analysis results are reflected in the test report (PDF form).

Submittal: submit the source document of 3D digital detection and the detection report in "PDF" format, named "JC". Save to the "MC" folder.

The score indicators are distributed as follows:

index	Coordinate Alignment	comparison	2D comparison	2D Dimension Measurement	Measurement Evaluation Geometric Tolerances	file save
Score	1 one	2 two	1 one	2.5 two point five	2.5 two point five	1 one

Scoring points: coordinate alignment shall be conducted as required, 3D shall be accurate, chromatograms shall be complete, and 2D comparison shall be analyzed and marked as required; The dimension and geometric tolerance shall be measured according to the data in the dimension check list. The geometric tolerance measurement shall be carried out. The measured elements and datum elements shall be correctly selected. The geometric tolerance items shall be correctly written according to the requirements. No score will be given for errors; Save the file path and name the file as required.

Module D scheme design

I. Task Description

Known conditions: A brand company plans to develop a two-way lock box. The main viewing surface of the bidirectional lock box is mainly composed of the lock cylinder, lock box, rotary handle and other main parts. The specific operation steps are as follows: rotate the handle, and the lock cylinder moves horizontally in opposite direction, as shown in Figure 4.

Fig. 4 Schematic diagram of two-way lock box

A two-way lock box shall be designed according to the conditions, and the size of the product shall not be less than 60 * 60 * 60; The appearance should not be the same as the picture. This module requires to complete the two-dimensional drawing (including dimensions, geometric tolerances, etc.) of all internal and external parts of the two-way lock box, and generate two-dimensional part drawings and two-dimensional assembly drawings.

II, Task requirements

1. The 2D part drawing and 2D assembly drawing are reasonable.

2. The technical requirements of two-dimensional part drawings and two-dimensional assembly drawings shall be clearly and specifically marked.

3. Draw two-dimensional drawings of all parts and mark the main dimensions. Gear rack parts need complete drawing information (mark all dimensions, dimensional tolerances, geometric tolerances, surface roughness, tooth profile parameters, etc.).

4. The two-dimensional assembly drawing shall be marked with dimensions and the fit relationship of main parts.

5. The two-dimensional part drawing and two-dimensional assembly drawing shall be consistent with the content required to be completed by the following tasks.

Submit: 2D part drawing and 2D assembly drawing scheme design source document. The part drawing is named as "LJ-1" and "LJ-2", the serial number is extended according to the number of parts, and the assembly drawing is named as "SJ-ZP", all of which need to be exported to "PDF" file format. Save to the "MD" folder.

The score indicators are distributed as follows:

index	View representation and technical requirements	Dimension of part drawing	Geometric tolerance of part drawing	Dimension of assembly drawing	Fitting relationship of assembly drawing
Score	5	4	2	2	2

Note: If the part drawing and assembly drawing are completely inconsistent with the content completed in the following tasks, no score will be given for this task.

Scoring points: the part view is reasonably selected, the structure is correctly expressed, the dimensions are complete, and at least one geometric tolerance is marked; The assembly relationship of parts in the assembly drawing is correctly expressed, the dimensions and matching relationship are fully marked, and the balloons are correct; The file saving format and naming meet the requirements.

Modle E: Design of internal motion mechanism of module E product

I. Task Description

Participants use computer pre installed software to complete the design of the internal motion mechanism of the two-way lock box according to the known conditions and design requirements.

II. Task requirements

1. The rotary handle must be used as the power source to guide the movement of the lock cylinder.

2. The two-way movement of the lock cylinder must keep synchronous operation.

3. The design of rotary handle shall reflect the integrated design concept.

4. Gear rack linkage shall be adopted between the handle and the lock cylinder (the gear shall be printed with a metal printer).

Submit: source document of 3D innovative design named "SJ-NB". Save to the "ME" folder.

The score indicators are distributed as follows:

index	Rotating handle as power source	Complete design of motion mechanism	Rack and pinion linkage	The connection mode between parts is reasonable	Integrated structure design
Score	1	3	2	2	2

Scoring points: complete 3D model design, complete transmission component design, integrated structure design of rotating handle, gear rack linkage design, and file storage format and naming meet the requirements.

Module F Product Appearance Design

I. **Task Description**

On the basis of Module E, the appearance design of the two-way lock box shall be carried out. The appearance design shall reflect the concepts of ergonomics, industrial design, etc. The appearance design shall not hinder the rotation function of the "rotating handle". Except for the "rotating handle", other internal mechanisms of the product shall not be external. It is required to draw the three-dimensional digital model of the appearance of the two-way lock box and the three-dimensional assembly drawing of the product, and make the simulation animation of the two-way lock box.

II. Task requirements

Task 1: Draw 3D digital model of product appearance

(1) The appearance is beautiful and conforms to ergonomics.

(2) The appearance design shall facilitate the assembly of the completed internal motion mechanism of module D and the disassembly and assembly of the whole product.

(3) The appearance design shall not hinder the rotation of the rotary handle and the movement of the lock cylinder

(4) The appearance design shall consider the convenience of installing the two-way lock box on the door in the later period.

(5) The overall appearance is stable.

Submit: 3D innovative design source document named "SJ － WG" (overall assembly result) and "WG". Save to the "MF" folder.

Task 2: Draw 3D assembly drawings of products

1. Complete assembly of product model parts;

2. Correct assembly relationship;

3. The constraint relationship is correct;

4. Assemble all the parts that make up the two-way lock box, and name the file "sheji zzp". Save to the "MF" folder.

Task 3: Make a simulation animation of the two-way lock box

1. Make the simulation animation according to the known conditions of the subject, and the motion simulation is required to correctly reflect the motion principle of each mechanism.

2. The animation runs in the 15-20s time range, rotates one circle, and the appearance gradually changes to translucent, showing the correct movement of the internal mechanism, and the appearance gradually changes to opaque, and completing a cycle of motion simulation.

3. Resolution size: 1024 × 768, output AVI format animation.

4. The file is named "fangzhen". Save to the "MF" folder.

The score indicators are distributed as follows:

index	Beautiful and ergonomic	Reasonable appearance and stable overall structure	A full cycle of mash animation	file save
Score	1	6	2	1

Scoring points: the appearance and modeling are reasonable, the structure meet the requirements, the assembly relationship is correct, the design function can be realized, the motion simulation can complete a full cycle of animation, the overall dimensions meet the requirements, and the file storage format and naming meet the requirements.

Module G 3D printing and post-processing of products

I. Task Description

According to the digital models completed by "Module D" and "Module E", and in combination with the 3D printing and forming equipment, supporting equipment operation software, processing consumables and other conditions provided by the venue, 3D printing and forming of products are carried out. participants choose computer pre installed 3D printing software to conduct 3D slicing of all parts of the two-way lock box, and choose appropriate 3D printing equipment for printing.

II, Task requirements

1. Input the data model to the 3D printing and forming equipment, select and set the processing parameters, and perform 3D printing and forming processing as required.

2. Print all parts constituting the two-way lock box, and print 1:1 according to the designed size.

3. Carry out basic post-processing for 3D printed parts: peeling support, surface grinding, etc.

4. The gear is made by metal 3D printing equipment.

5. The assembly between parts is not allowed to be bonded, and the assembly method is reasonable.

Submission materials: assemble the printed and post-processing parts into a complete product, put the envelope with password into the storage box, and seal it with a sealing strip.

The score indicators are distributed as follows:

index	Appearance and surface quality	printing of non-metallic products	Metal 3D printing gear	Integrated structure printing	Post processing of 3D prints	Overall assembly	Implement functional requirements	Professional quality
Score	2	7	2	2	2	2	5	3

Scoring points: 1:1 printing shall be carried out according to the designed size, and the parts shall be printed completely; Integrated structure design shall be printed as a whole; Printing gears with metal printer; The support of the printed copy shall be removed and the surface shall be smooth; Overall assembly to achieve the functions required by the design.