Rapid Casting Prototype Modeling and Development Case study

This project done by:

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Rapid prototype definition

• The rapid prototype (RP) is an important technique in development and introducing new innovated products for industries and public.

• Prototype is commonly used to test the functionality and efficiency of the product before going to actual production line.

• RP classification: Direct, Indirect, Semi-direct
Rapid prototype definition

- Direct tooling involves use of RP models themselves as patterns and core boxes for sand casting application.

- Indirect tooling makes use of RP models as intermediate masters for producing final patterns and core boxes.

- Semi-direct tooling involves the use of RP systems to make dies for producing wax patterns for investment casting.
Project Objectives

• RP technique is monopolized by modern industrial countries. Hence, the main objectives from the current project are transferring this type of technology to Saudi Arabian industries.

• In this project rapid casting prototype technique (direct method) will be applied to manufacturing a selected casting from a developed local product.
Project objectives

- It is decided to select casting from a local water pump manufacture, which is **pump-motor support** casting. [Alsamhan Factory for Saudi Pump Co., Ltd]
Project Roadmap

1. 3D Solid model generation from the given 2D drawing
2. 3D solid model of support master patterns
3. CAM system for support pattern and master core pattern
4. G-code program and CNC machining
5. Develop resin core box
6. Sand molding and casting process
Step 1: 3D Solid model generation from the given 2D drawing
Step 2: 3D solid model of support master patterns (TOP + Bottom sides)
Step 2: 3D solid model of support master patterns core box (top and bottom sides)
Step 3: CAM system for support pattern (top and bottom sides)

MasterCam software.

Three Cutting Process: Facing, roughing and finishing process.
Step 3: CAM system for master core pattern (top and bottom sides)

MasterCam software.

Three Cutting Process: Facing, roughing and finishing process.
Step 4: G-code program and CNC machining

- Developed G-code from CAM system will be used by Anilam CNC controller generates the master patterns.

Experimental Work-shop work:
(1) CNC Gate vertical machine.
(2) Anilam 3000 Controller and its external CRT.
(3) PC laptop used as DNC system.
Step 4: G-code program and CNC machining:
Raw material preparing
Step4: G-code program and CNC machining:
Mounting raw material and setting pattern reference
Step 4: G-code program and CNC machining:
Milling the resin top pattern
Step 5: Develop resin core box:
Resin patterns (top and bottom half) after removing external waists
Step 5 : Develop master resin core box :
Resin master core patterns after removing the external waists
Step 5: Develop resin core box:
1- releasing agent coating
2- resin core box frame,
3 and 4- resin casting,
5- flip over the resin box,
6- remove the master pattern from resin core box.
Step 5 : Develop resin core box :
Final resin core box and after releasing agent coating
Step 6 : Sand molding and casting process:
1- Pattern setting in Cope,
2- Fill in green stand,
3- Cope after removing the pattern,
4- Sand core,
5- Insert and checking the contact between core and cope surfaces.
Step 6: Sand molding and casting process:
Molding flask (cope and drag) assembly Pattern molding plate
Step 6: Sand molding and casting process: cope and drag molding + riser + sprue + gating system
Step 6: Sand molding and casting process: Core assembly
Step 6: Sand molding and casting process:
Close the flask
Motor-pump support after casting process, shot pasting and grinding
Motor-pump support after finishing
Summery and Conclusions and Suggested Future work

• The rapid prototype (RP) is important technique in development and introducing new innovated products for industries and public.

• Prototype (RP) is commonly used to test the functionality and efficiency of the product before going to actual production line. This will save the time and costs e.g. tooling cost and manufacturing cost.

• Rapid prototype technique is monopolized by modern industrial countries. The main objectives from the current project are transferring this type of technology to Saudi Arabian industries.

• In can be concluded, rapid prototype technique can be used in Saudi Arabian industries to develop a new innovated products.

• As future work, it is recommended to investigate different RP direct methods to manufacture the resin patter and core box directly from the developed 3D CAD file using 3D resin printer.
Thank you for listening...