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Analysis of Investment Casting Components to Improve Casting Practice by Various Computational Techniques to Reduce the Causes of Defects

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Abstract

The objective of this project is to identify defects in investment casting process. A case study has been conducted, involving more than one mechanical part in an investment casting industry. Few of most common defects found in investment cast parts are blowholes, shrinkage cavity, porosity, cold shuts, sand inclusion, misrun, bulging and cracks. Now a days, computational software for investment casting process has begun to complement the design based approach in meeting the demands of higher quality investment cast parts in a cost effective manner. The computations will carry out using Autocast x1 software and the defect will be predicted.
Keywords: Investment Casting, Defect Arising Reason, Process Analysis, AutoCAST_X1, Rejection Rate

I. Introduction

The idea is basically to reduce the casting rejection. The project is all about reduce the casting defects by the help of the computational techniques. The process is begin with the analysis of the investment casting procedure. Select the appropriate material and component for the analysis of casting defects. We are working to find the effective computational technique for the change in the design to reduce casting defect. We analyze the various casting material to see the defects occur in the various material. We analyze the sand coating process, wax pouring process to find the lack of procedure lag. We analyze the die design to eliminate the die defect.

II. Literature review

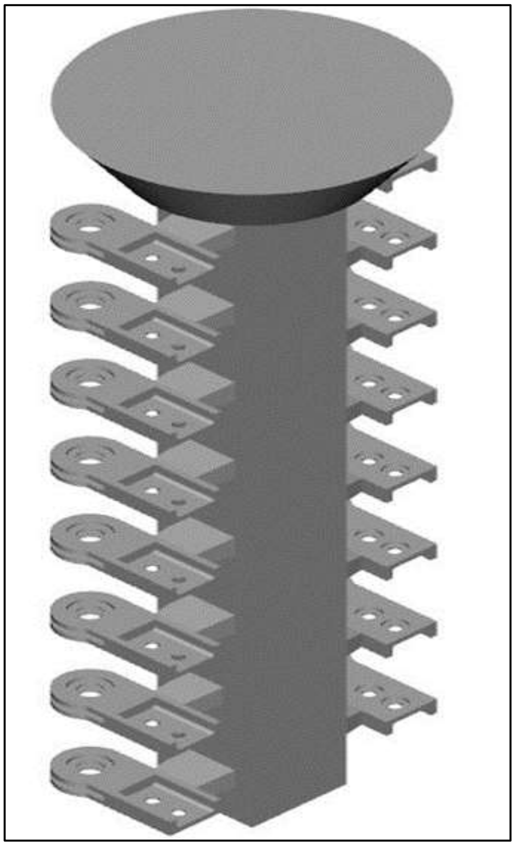
Dr. Grant Bradley (REMET UK), The paper reports the use of temperature ramped controlled stress and temperature controlled FTIR to investigate the behavior of wax during the autoclave process. Experiments have been carried out to investigate factors affecting the flow and absorption characteristics of wax at the shell/wax interface during the early stages of the autoclave process. Results are reported focusing on the variation in time and temperature response of various waxes, and the potential effects upon the dewax process.

Chuan Huat, Sulaiman Hassan, Sulastri Sabudin, Saparudin Ariffin, To verify the accuracy of the simulation model, the computer predictions are compared with the experimental result. It shows that there is excellent agreement between computer predicted and the actual defect on the casting part.

Rajesh Rajkolhe, J. G. Khan In this research work different casting defects are studied. By referring different research papers causes and their remedies are listed. These will help to quality control department of casting industries for analysis of casting defect. This study will definitely be helpful in improving the productivity and yield of the casting. Rejections of the casting on the basis of the casting defect should be as minimized and all the above research is heading in the same direction.

X.P.Zhang, Temperature distributions in investment castings and shells are of great influence on the quality of investment castings, many efforts have been made in the numerical simulation of heat transfer in the investment casting process. To improve the computational efficiency of solidification simulation of the investment casting process, the component-wise splitting methods and the irregular mesh technique were employed, a numerical simulation of 3D temperature field of investment castings was developed and eight practical investment castings were simulated with focus on the computational efficiency.

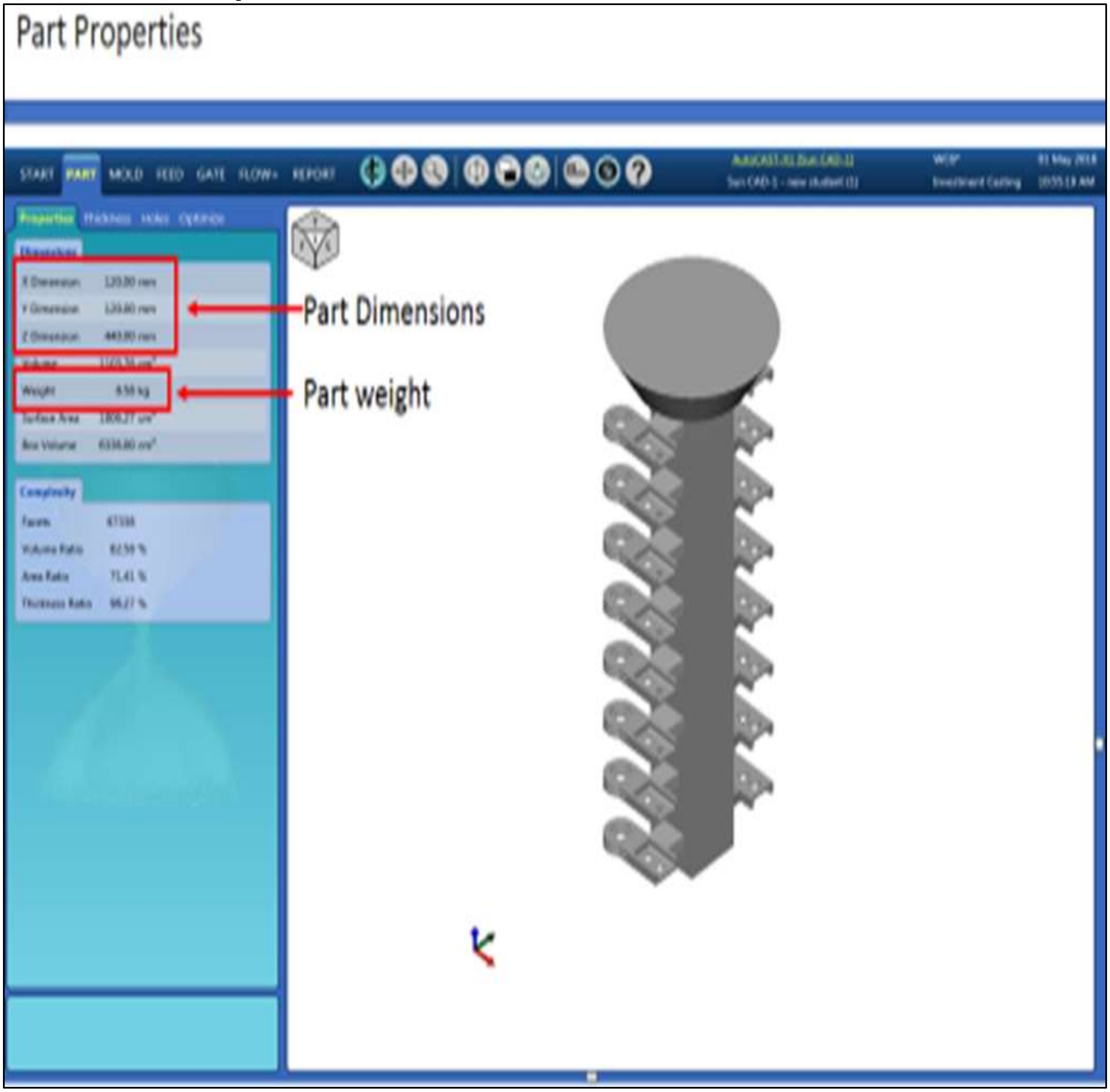
III. DESIGN OF COMPONENT

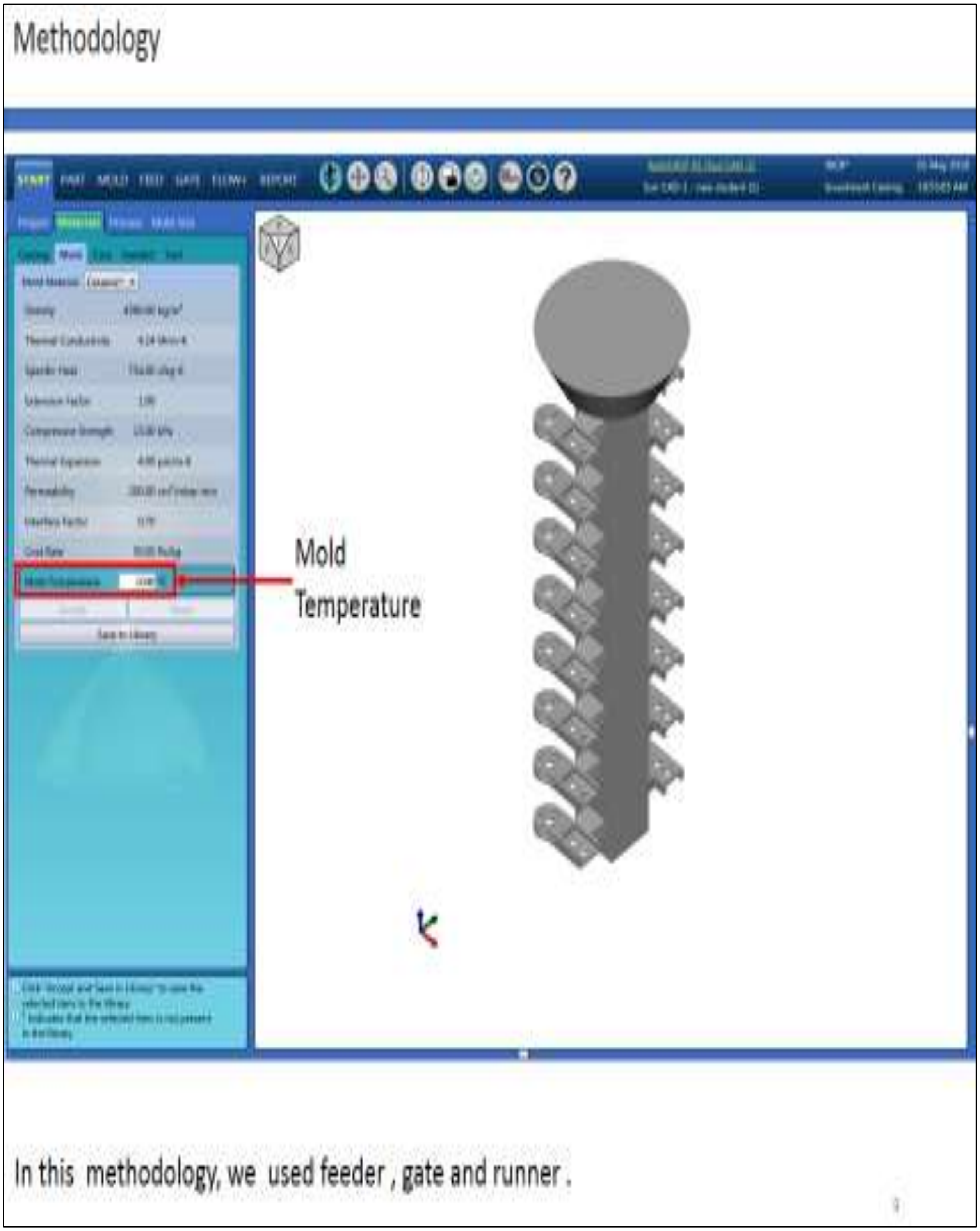


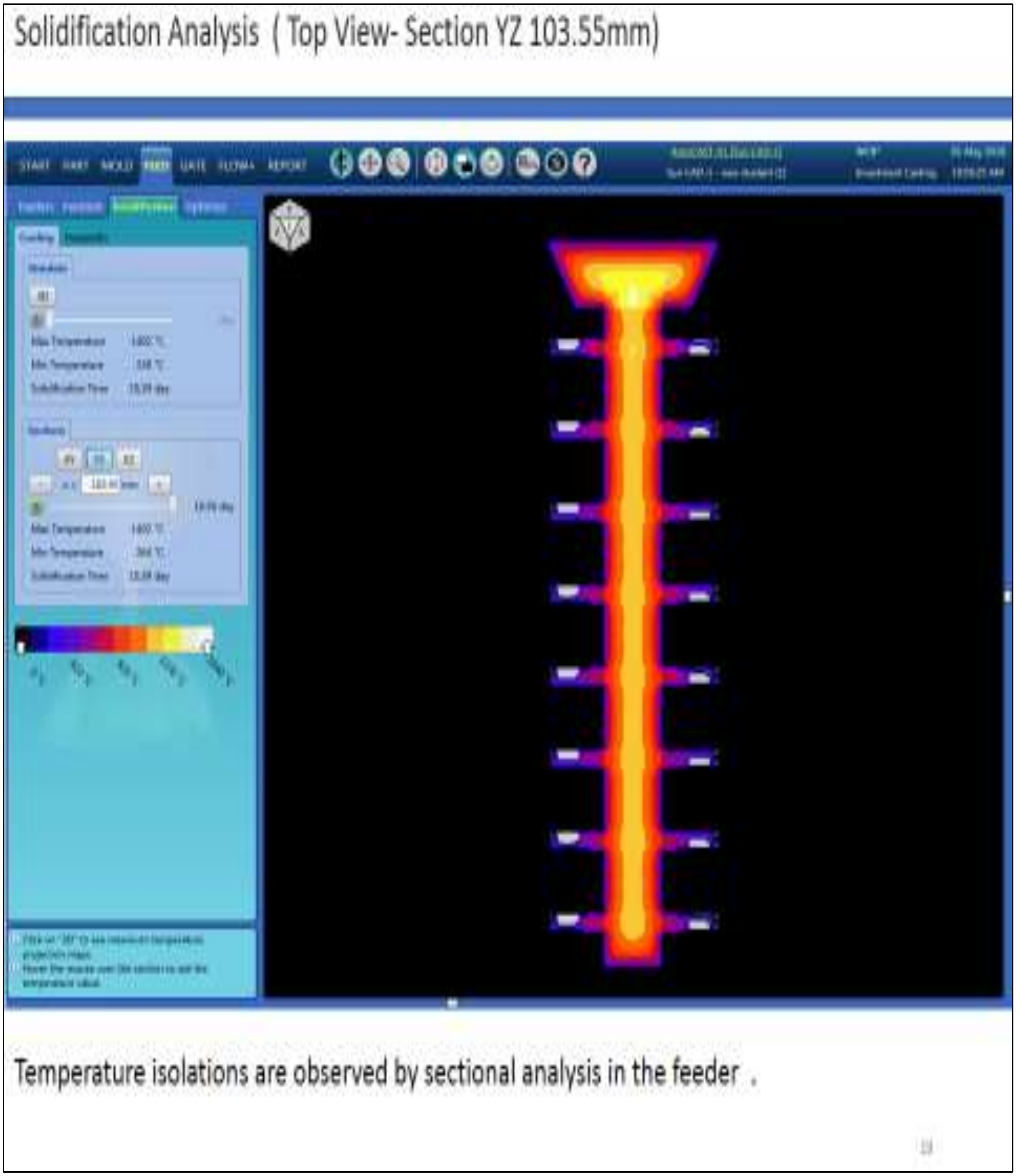
A. *Principle:*

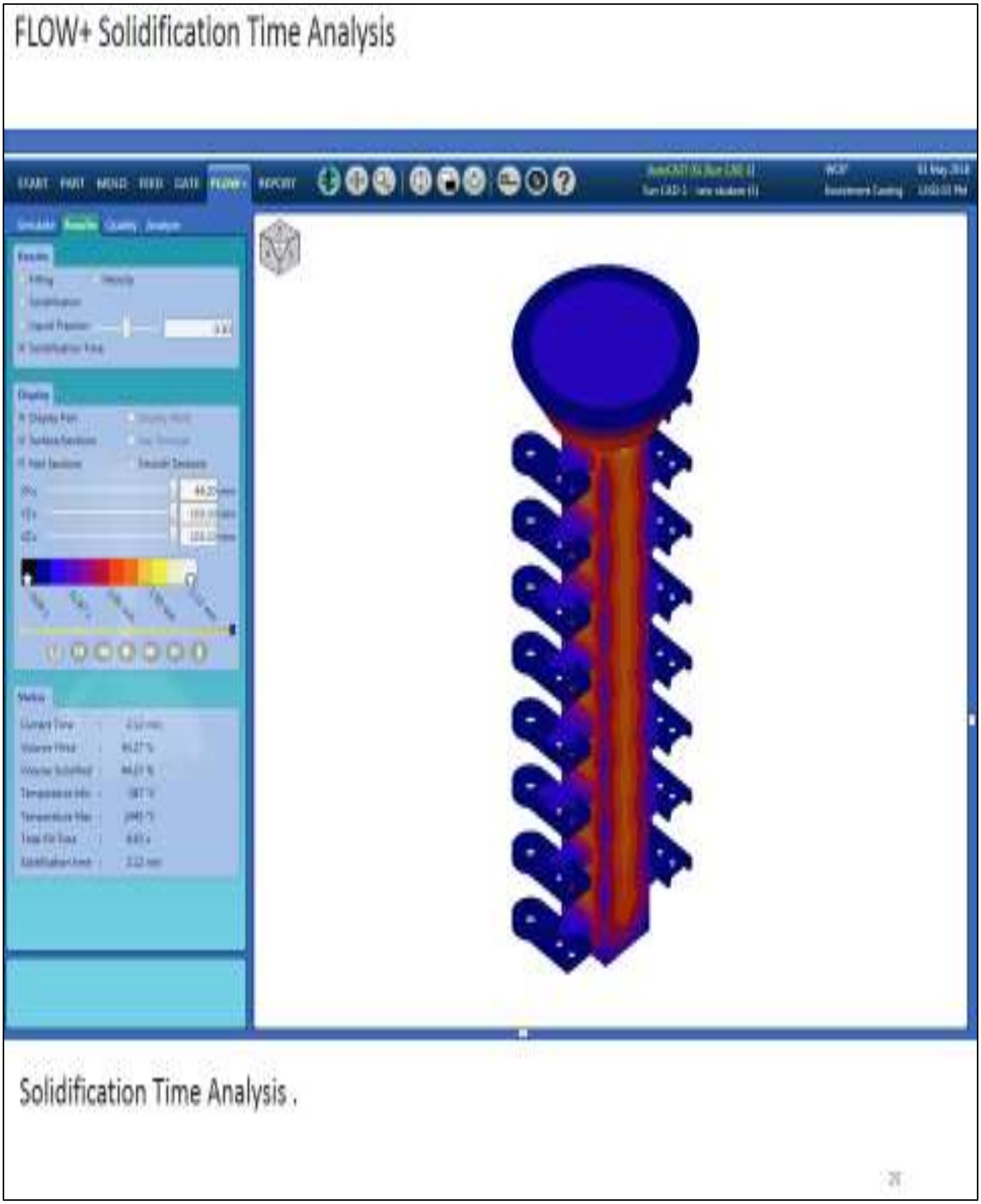
Our analyses is basically of the investment casting component at the solidification period. It is about the defects like cold shut and shrinkage. These type of defects can be analyze by the software AutoCAST-X1 and we can find the solution of the defect cause reason.

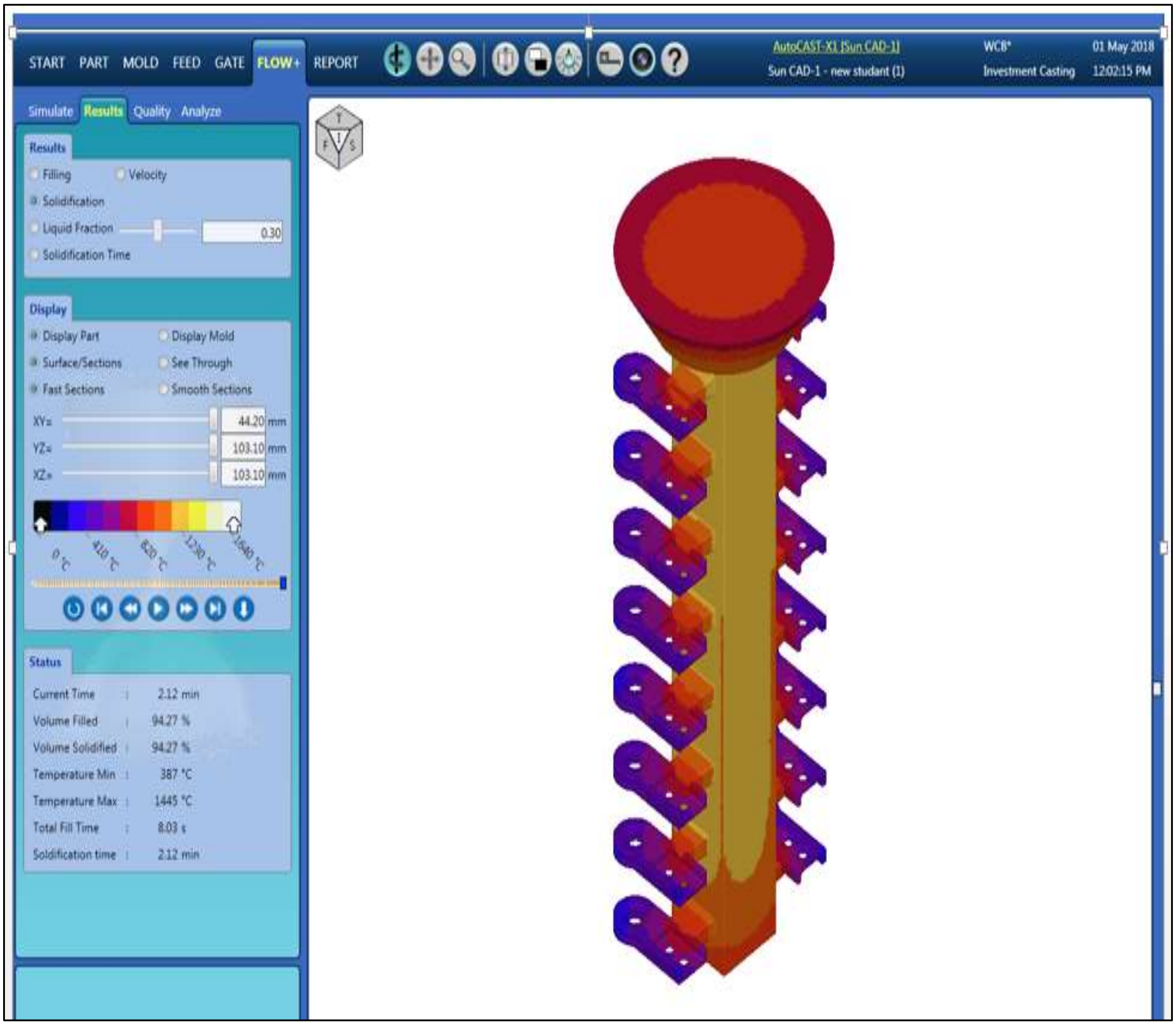
1) Autocast-X1 Simulation Report




Methodology
Mold
Temperature
In this methodology, we used feeder , gate and runner .


Solidification Analysis (Top View- Section YZ 103.55mm)
Temperature isolations are observed by sectional analysis in the feeder .


FLOW+ Solidification Time Analysis
Solidification Time Analysis .



2) Solution Matrix

Defect	*Solution*	*Causes*
Burr	*Reduce by putting the dehumidifier in the sand shelling area*	*Air inclusion*
Bulging	*After the coating of the sand the shell should be placed for proper drying*	*Wet sand coating*
Mould breaking	*7 Coat of the sand and binder*	-
Cold shut	*Suitable pouring temperature, Proper given time period for shell packing*	*Low pouring temperature, Lack of fluidity of molten metal, Lack of venting*
Slurry, Sand Inclusion	*Suitable pouring temperature, Suitable period for shell backing*	*Higher pouring temperature, Improper backing of mould*
Parting line defects	*Removal of parting line by knife*	*At the wax pouring level the the parting line between dies drag and cop*
Shrinkage	*proper pouring time , definite number of component at one side*	*Shrinkage allowance , tree solidifies before the component , higher number of component at one side of tree*
Sand Wash	*improper first coat of the zirconium , use various additives or binders*	*Metal penetration into the moulding sand , because of the sand particle which are too coarse*
Gas interruption	*Pouring of metal by worker should be laminar flow , turbulence should be minimum*	*Pouring of the metal is done manually so at the stage of pouring the rate of the pouring*

IV. CONCLUSION

From the analyses of the AutoCAST-X1 we can conclude that if the gate size increase by 7 to 10 cm the problem of the cold shut will reduce. The rejection rate after the solidification out of 100 was 12 to 14 will reduce up to 4 to 6 and after the machining the rate out of 100 was 20 to 24 will reduce to the 12 to 14.

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