



University of Miskolc
Faculty Materials Science And Engineering
Antal Kerpely Doctoral School of Materials Science
& Technology



Theoretical basics and simulation of foundry processes

Dániel Molnár, PhD

SUBJECT DESCRIPTION

2016.

Theoretical basics and simulation of foundry processes

Dániel Molnár, PhD

Lecturer

Dániel Molnár PhD., associate professor, Institute of Foundry Engineering

Room: B1 3rd floor 307. Mail: daniel.molnar@uni-miskolc.hu, tel.: 1707, 20/4955920

http://metont.uni-miskolc.hu/?page_id=2602

Group of target

PhD students of the Kerpely doctoral school, especially for the students of the Foundry topic.

Language

Hungarian and English

Objectives

The aim of the course is to experience and understand the phenomena of casting filling and solidification, to give an introduction on modelling and computer simulation of phenomena as heat flow required to model and simulate the casting process.

Methods

Lectures and individual education meetings. Representation of the topics that cover the parts of the curriculum and the literature. Definition of assignment for the topics, definition of simulation methods and software. Facilitate of access for the simulation software.

Contents

Examination of temperature fields during filling and solidification. Examination of macro phenomena affected by the changes of temperature fields. The reason of volumetric changes, shrink holes, and piping, the examination of them. Residual stresses and the connected phenomena. Realization of derived solidification, theoretical and practical methods. Physical and chemical interactions of the melt and the form.

Computer simulation of the technological process of casting. Modelling of form filling for the calculation of the gating system. Simulation of casting solidification, determination of the feeding system. Analytical and numerical methods for the calculation of heat conduction. Programming of heat conduction using control volume method. Determination of material properties and casting defects using simulation.

Progression

Topic 1.

The elements and design of gating system, calculation methods. Filling time calculation methods. Flow resistance in the gating system. Shrinkage of metals and its alloys, shrink holes, piping. Theory of the residual stress of castings and the consequences.

Topic 2.

Simulation of foundry processes, the system of simulation projects. Mesh generation and meshing methods. Control volume method. Attributes of given casting methods (gravity, investment, HPDC, LPDC) and the considerations of the technological parameters.

Literature

1. Nándori Gyula: Elméleti Öntészet I-II., Tankönyvkiadó, Budapest, 1985
2. Doru Stefanescu: Science and Engineering of Casting Solidification, Springer, Ohio, 2009
3. D.U. Furrer: Fundamentals of Modelling for Metals Processing, ASM Handbook Volume 22A-B, ASM, Ohio, 2009
4. Jesper Hattel : Fundamentals of Numerical Modelling of Casting Processes, Polyteknisk, Lyngby, Denmark, 2005

Fulfilment

Oral exam, solution of a simulation project

Complex questions

1. Casting solidification, physical background and thermodynamics. Theory of the feeding system design, elements of derived solidification.
2. Interpretation of fillability and flowability, melt flow in the gating system in case of different pouring methods.
3. Residual stresses of castings, mathematical solutions for stress calculation.
4. Simulation of foundry processes. Attributes of given casting methods and the considerations of the technological parameters.
5. Analytical and numerical methods for the calculation of heat conduction. Programming of heat conduction using control volume method.