SUMMARIES

Krawiec A., Chyła P., Chyła P., Bednarek S., Łukaszek-Sołek A.:

Numerical Analysis of the Influence of Lubrication Conditions on the Filling Pattern in a Complex Process of Extruding Particular High--Melting Materials

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In this paper, the process of extrusion was analyzed numerically for a axisymmetric forging model where there is a complex material flow diagram (Fig. 1a). The analysis was performed assuming a different stoke slenderness ratio so you can control how to fill the die impression (direct extrusion, in direct and side – Fig. 1b)–d), using lubricants with different values of friction factor.

Keywords: *complex extrusion, controlled lubrication, Inconel®718 alloy, Ti-6Al-4V alloy, numerical modelling*

Czarski A., Matusiewicz P.:

Influence of Measurement System Quality on the Evaluation of Process Capability Indices

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Among statistical instruments of quality Statistical Process Control (SPC) and Measurement Systems Analysis (MSA) take particular place. The proper quality of measurement data – verification and assurance of this quality are the task of MSA – guarantees an opportunity to carry out a solid SPC analysis supplying information about a process behavior. One of the principal tasks of SPC is estimation of capability of a process i.e. the assessment of process potential as for variability regarding expectations defined by specification limits. Data for analysis of a process capability are the results of measurements made by means of a determined measurement system. The variability of this measurement system must influence the results of capability assessment, however the measurement system adequate to control the process should guarantee that the impact is little enough to be omitted.
The subject of the work is the analysis of influence of measurement system variability on evaluation of process capability indices. The mutual relations between process variability and measurement system variability present analytical relationships and experimental research given in the work. The aim of the tests was an assessment of a capability of the process of steel drop forgings' heat treatment relating to a hardness. The methodology demonstrated in the work is valid quality standards compatible (ISO 9000, ISO/TS 16949 etc.).

Keywords: *quality management, statistical methods, statistical process control (SPC), measurement systems analysis (MSA), R&R method, capability analysis*

Szucki M., Suchy J.S.:

A Method for Taking into Account Local Viscosity Changes in Single Relaxation Time the Lattice Boltzmann Model

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The aim of this work is to develop a numerical model, based on the lattice Boltzmann method, which allows for stable stimulation of incompressible fluid flows, including local changes in kinematic

viscosity. The authors' interest lies in processes which take place during mould filling. In this publication, general information on the lattice Boltzmann method for two-dimensional single-phase flows were presented. A solution, based on the so called Fractional Step algorithm, which allows for defining kinematic viscosity in each mesh cell individually, was shown. The authors also described in detail a validation procedure for a presented model with the use of commercial simulation environment COMSOL Multiphysics. The results confirmed the correctness of the proposed solution. The presented method can be successfully used for the effective numerical modeling of liquid metal flows inside a casting mould.

Keywords: *lattice Boltzmann method, local viscosity changes, kinematic viscosity, temperature, lid driven cavity*

Szucki M., Suchy J.S.:

A Voxelization Based Mesh Generation Algorithm for Numerical Models used in Foundry Engineering

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The aim of this study is the adaptation of the voxelization algorithm for the generation of regular computational meshes used in numerical models. The authors concentrate on solutions, which can be applied in a computer modeling of phenomena occurring in the foundry industry. The presented mesh generation process is the STL files based. This file format is generally used in the commercial simulation software. The basic voxelization algorithm extended with such functions as: the input data correctness control (virtual geometry), the formation of meshes consisting of several subdomains corresponding to individual elements of the foundry technology (mould, casting, core, feeder etc.) and the possibility of the mesh local refinement (adaptive grids), is presented in the hereby paper. The described solution is characterized by high efficiency and when combined with the proper numerical model can be successfully implemented in problems related to computer simulation of foundry processes.

Keywords: *mesh generation, regular mesh, cell, voxelization, adaptive grids, lattice Boltzmann method*

Żak P.L., Suchy J.S.:

Numerical Model for Dendrite Growth – an Application of the Rank Controlled Differential Quadrature Method

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Rank Controlled Differential Quadrature (RCDQ) is an innovative method for numerical approximation of problems described by Partial Differential Equations (PDEs). In this paper the authors apply the RCDQ for the numerical simulation of a simplified model for dendrite growth during Al-Ti alloy crystallization. The authors put most concern on building an accurate numerical model for this phenomenon. In the simplified model the symmetry and flux on boundary condition appears. Additionally, dendrite tip growth into adjacent liquid change the computation domain size, what indicates a need for node coordinate recalculation during each new time step. The authors analyze the results of numerical modelling of alloying element concentration and dendrite growth rate. The modelling results shows that the RCDQ method can be used for modelling problems with moving grid and that the method approximation proposed by the authors is proper.

Keywords: *numerical modelling, rank controlled differential quadrature, dendrite growth, moving grid problem, crystallization*

Kmita A., Hutera B.:

The Influence of Physical and Chemical Parameters of Modified Water Glass on the Strength of Loose Self-setting Sands with Water Glass

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An attempt of water glass modifying by 30% water bochmite Al(OH)O solution was undertaken. The flow curves were determined and the binder viscosity estimated from them. The quartz wettability by binders was determined by measuring the wetting angle θ changes with time. Strength properties of moulding sands with fractions of modified binders were verified by checking the tensile strength R_m^u after various hardening times under environmental conditions. The R_m^u value after 24 h of hardening was assumed for the analysis.

Keywords: *viscosity, wettability, modification, water glass*

Bobrowski A., Grabowska B.:

The Impact of Temperature on Furan Resin and Binder Structure

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Exposure to high temperature causes a series of structural changes in binders used to prepare moulding and core sands. These changes may consist in the formation of new bonds, changes to their character or a transformation of the structure which may be accompanied, for example, by the destruction (disappearance) of some chemical bonds. They have a significant impact on the mechanical and technological properties of sands, but also on their environmental noxiousness or the ability to reclaim the sand. This article presents the results of infrared structural examinations of two furan resins and two binders produced based on those resins. Both pure resins and binders made of them were exposed to temperature. Changes taking place in their structure in the 25–200 ^{o}C temperature range were determined using infrared spectroscopy.

Keywords: *furan resins, furan binders, FTIR, ATR*