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3D FINITE ELEMENT ANALYSIS IN THE SELECTIVE LASER MELTING PROCESS

Contuzzi, N.; Campanelli, S. L. & Ludovico, A. D.
Polytechnic of Bari, Department of Management and Mechanical Engineering, Viale Japigia, 182, 70126 Bari, Italy
E-Mail: n.contuzzi@poliba.it

Abstract
Selective Laser Melting (SLM) is actually the most attractive technique in an Additive Manufacturing (AM) technology because of the possibility to build layer by layer up nearly full density metallic components without needing for post-processing. One of the main problems in SLM processes is represented by the thermal distortion of the model during forming; the part tends to be deformed and cracked due to the thermal stress. Therefore, it is important to know the effect of the process parameters on the molten zone and consequently on the density of the consolidated material. Great advantage can be obtained from the prediction of temperature evolution and distribution.

The aim of this study is to evaluate the influence of the process parameters on the temperature evolution in a 3D model. The developed code evaluates the distribution and evolution of the temperatures in the SLM process and simulates the powder-liquid-solid change by means of a check of the nodes temperature. 12 refs.
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Key Words: *Rapid Prototyping, Selective Laser Melting, FEM, Metal Powders*

Pages 122-132

LAYOUT OPTIMIZATION OF POWER MODULES USING A SEQUENTIALLY COUPLED APPROACH

Hammadi, M.; Choley, J. Y.; Penas, O.; Louati, J.; Rivière, A. & Haddar, M.
LISMMA, SUPMECA 3 rue Fernand Hainaut 93407, Saint-Ouen Cedex, France
E-Mail: moncef.hammadi@Supmeca.fr

Abstract
Nowadays, the design of Power Modules (PM) is shared between multidisciplinary teams of designers using various modelling tools. Consequently, optimizing the layout of PM is a long process with high risk of errors.

In this paper, a sequentially coupled approach is proposed to optimize this process. This integrated method is based on coupling physical models and applying an optimization process. It is illustrated through the example of the layout of a half-bridge Mosfet power module exposed to electric and thermal constraints. So, physical models and software components have been developed, in order to define the multidisciplinary design process and then to perform the layout optimization using the NLPQL algorithm.

It is shown that, the proposed approach allows automatic data exchange between physical models and optimal configurations are proposed with reduced design time and risk. Therefore, this integrated approach shows a great improvement in the design of PM and multidisciplinary products. 10 refs.
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Key Words: *Multidisciplinary Design, Multi-Physical Coupling, Layout Optimization, Power Modules*

Pages 133-144

MODELLING AND SIMULATING A CONTROLLED PRESS-BRAKE SUPPLY SYSTEM

Lovrec, D. & Kastrevc, M.
University of Maribor, Faculty of Mechanical Engineering, Smetanova 17, SI-2000 Maribor, Slovenia
E-Mail: d.lovrec@uni-mb.si

Abstract
Modern machinery and equipment manufacturers incorporate advanced technology into their products. This is especially true for those applications where an electro-hydraulic supply system is used, e.g. on tool and metal shaping/forming machines. Such machines represent a complex and multitechnological mechatronic system, and should be first modelled and simulated, especially in respect of dynamic behaviour.

This paper presents a theoretical analysis of an energy-saving and cost-effective electro-hydraulic supply system on a hydraulic press-brake, used within the automotive industry. It emphasises the designing an adequate mathematical-simulation model, to serve as the basis for decisions concerning the used supply system's dynamic. 9 refs.
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Key Words: *Metal Forming Machines, Electro Hydraulic System, Modelling, Simulation*

Pages 145-157

INVESTIGATIONS ON THE DYNAMIC STATION KEEPING OF AN UNDERACTUATED AUTONOMOUS UNDERWATER ROBOT

Santhakumar, M. & Asokan, T.
Robotics Research Laboratory, Dept. of Engineering Design, Indian Institute of Technology Madras, Chennai 600036, India
E-Mail: santharadha@gmail.com

Abstract
In this paper, a new method for station keeping of underactuated underwater robots in the presence of underwater currents and external disturbances is proposed. Three small additional thrusters are introduced for station keeping purpose which are less power consuming and are actuated only during the station keeping mode. These thrusters are located in such a way that the generated forces and torque are enough to compensate the underwater currents and disturbances. Station keeping thrusters' locations and directions are nearly optimized using Taguchi's robust design method. The effect of additional thrusters on robot tracking control performance is investigated and the results are presented. The effectiveness of the proposed configuration is demonstrated with the help of hardware-in-the-loop (HIL) simulations using an experimental autonomous underwater robot. The underwater current effect on the corresponding motions of the underwater robot is investigated and some interesting phenomena with respect to different underwater current amplitudes and directions are observed. Robustness of the proposed configuration is also investigated. 28 refs.
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Key Words: *Station Keeping, Underwater Robot, Underwater Current, Tracking Control, Underactuated Control*