name of the unit:

DIVISION OF NUMERICAL METHODS IN MATERIALS ENGINEERING

Institute of Materials Science and Engineering, Lodz University of Technology

symbol:

I-11

http://www.iim.p.lodz.pl

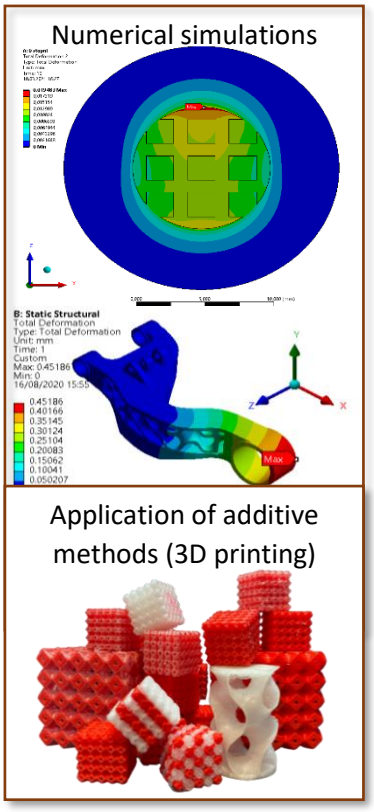
head of the unit:	potential promoters:	contact person:
Jacek Sawicki, PhD, DSc, TUP Prof.	Jacek Sawicki, PhD, DSc, TUL Prof. Emilia Wołowiec, PhD, DSc, TUL Prof.	Jacek Sawicki, PhD, DSc, TUL Prof. phone: 42-631-3037 jacek.sawicki@p.lodz.pl

scope of activities:

The main areas of interest and research directions are:

- models and algorithms for multi-stage carburizing processes, variable-temperature processes and repair processes,
- neural and heuristic models, searching for optimal parameters of the vacuum carburizing process based on the assumed properties of the layer after the carburizing process,
- algorithms for hardening steel elements with a carburized layer in gases under high pressure,
- physical models and their functional solutions for multi-segment low-pressure nitriding with the structure of the "boost - diffusion" process,
- numerical models of residual stresses in the surface layer after the various surface and thermo-chemical treatments,
- numerical superposition of stresses and the synergistic effect of modern methods of mechanical, thermo-chemical treatments taking into account the conditions of external loads,
- stress and deformation control algorithms for devices for high-performance vacuum carburizing,
- design of complex spatial shapes for 3D printing

graphic material



present activities:

The research activity of this Department is mainly related to the use of advanced mathematical-physical, numerical, statistical, and related methods in the modeling and optimization of surface treatment and thermochemical processes. Knowledge of these systems is also used to program devices or create advanced software. Computer systems are also used in dimensional analysis and the design of complex spatial shapes. Additionally, the Department focuses on research on material modifications in terms of strength and functionality, based on chemical and mechanical modifications.

Future activities:

Development and improvement of mathematical and numerical models of surface engineering processes and engineering systems. 3D printing. 3D printing of complex geometric structures with various internal fillings - TPMS (Triply Periodic Minimal Surface).

Publications/patents, awards, projects:

- P. Baras, J. Sawicki: Numerical analysis of mechanical properties of 3D printed aluminium components with variable core infill values, Journal of Achievements in Materials and Manufacturing Engineering 103/1 (2020) 16-24. DOI: https://doi.org/10.5604/01.3001.0014.6912

- Brancewicz-Steinmetz E, Sawicki J, Byczkowska P. The Influence of 3D Printing Parameters on Adhesion between Polylactic Acid (PLA) and Thermoplastic Polyurethane (TPU). Materials. 2021; 14(21):6464. https://doi.org/10.3390/ma14216464
- E. Wołowiec-Korecka, M. Korecki, L. Klimek. Influence of flow and pressure of carburizing mixture on low-pressure carburizing process efficiency. Coatings - Surface Treatment for Alloys 2022, 12, 337-344. DOI:10.3390/coatings12030337
- E. Wołowiec-Korecka, M. Korecki, M. Sut, A. Brewka-Stanulewicz, P. Kula. Calculation of the mixture flow in a low-pressure carburizing process. Metals 2019, 9(4), 439-446. DOI:10.3390/met9040439

We conduct the following research projects:

- Project NCBiR POIR.04.01.04-00-0087/15 " Equipment for high performance and precise heat treatment with a quenching deformation reduction system for direct application in downstream production chains of mechanical gearing and bearings."
- Projekt LIDER/3/0025/L-12/20/NCBR/2021 „Ferrytyczne azotonawęglanie niskociśnieniowe w uniwersalnych piecach próżniowych”

Keywords:

modeling, numerical simulations, ANSYS, heat treating (carburizing, nitriding, quenching), 3D printing, surface modifications

List of internship proposals in this research team:

Postdoctoral fellowships and fellowships for doctoral students and second-cycle students in grants related to the following

works: experimental investigations, development of mathematical and simulation models, identification and study of heat phenomena in engineering systems.