

# Wydział Inżynierii Mechanicznej i Informatyki

Politechnika Częstochowska

## Wyznaczanie współczynnika wymiany ciepła pomiędzy odlewem a formą odlewniczą z wykorzystaniem algorytmów sztucznej inteligencji

Determination of the heat transfer coefficient between  
the casting and the casting mold using the artificial  
intelligence algorithms

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# Abstract

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The doctoral dissertation concerns the development and examination of swarm algorithms to determine the heat transfer coefficient through the layer separating the casting and the casting mold. This work covers selected issues at the intersection of computer science and thermomechanics.

The dissertation demonstrates the validity of the thesis about the possibility of using artificial intelligence algorithms to reconstruct the value of the heat transfer coefficient occurring in the boundary condition of the fourth type during modeling of the heat conduction of two-component alloys with the use of two artificial intelligence algorithms.

The work consists of an introduction, a theoretical part, and a practical part. The doctoral thesis consists of eight chapters supplemented with a list of figures and tables, a bibliography, and a summary in Polish and English. The most significant achievements of the dissertation are included in the practical part. Chapters from five to eight contain detailed descriptions of the computer simulations necessary to achieve the set goals and prove the thesis.

The crucial tasks performed as part of the work include:

- review of the current state of knowledge on combining the possibilities of supporting engineering works with elements based on artificial intelligence,
- modification of the existing proprietary software in the field of modeling and computer simulations of heat conduction during solidification and cooling of castings,
- conducting primary research and analysis of the impact of algorithm input parameters on the final solution obtained,
- study and comparison of the impact of two nature-inspired algorithms on the reconstruction of the heat transfer coefficient through the separating layer,
- extending the existing research using artificial intelligence algorithms in thermo-mechanics.

The doctoral dissertation falls within the scientific discipline: of mechanical engineering. Still, its subject matter includes applied computer science and computational mechanics.

The material presented in the doctoral thesis does not close all research opportunities in this field. On the contrary, it has excellent potential for the future and development.

