



UNIVERSITÀ DEGLI STUDI
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Erasmus Mundus Consortium “MathMods”

Double Master's Degree Programme in
Mathematical Modelling in Engineering: Theory, Numerics, Applications

Master of Science in Mathematical Engineering	Master of Science in Technical Physics Specialization Advanced Computational Methods in Materials Science
University of L'Aquila, Italy	Gdańsk University of Technology, Poland

In the framework of the
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Master's thesis

An algorithm for evaluating the velocity field of the free convection in the vicinity of an isothermal vertical plate using the temperature field

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**GDAŃSK UNIVERSITY
OF TECHNOLOGY**

FACULTY OF APPLIED PHYSICS AND MATHEMATICS

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Second cycle studies

Mode of study: Full-time studies

Field of study: Technical Physics and Mathematical Engineering

Faculty: Applied Physics and Mathematics

MASTER'S THESIS

Title of thesis

An algorithm for evaluating the velocity field of the free convection in the vicinity of an isothermal vertical plate using the temperature field

Title of thesis (in Polish)

Algorytm szacujący wektorowe pole prędkości dla konwekcji naturalnej w bliskim położeniu izotermicznej pionowej płyty przy użyciu pola temperatur

Supervisor	Head of Department
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Date of thesis submission to faculty office:



**Erasmus
Mundus**



Erasmus Mundus Consortium "MathMods"
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Theory, Numerics, Applications



Declaration of Authorship

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Mode of studies: Full-time studies

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Abstract

Based on results of a recent experiment [International Journal of Heat and Mass Transfer 78 (2014) 1232–1242], a new algorithm is presented for evaluating the velocity field of the heat convection flow from a vertical plate using the temperature field. Using the coordinate transformation to the ones, defined via streamlines, and visible in such coordinates approximations, it is possible to express the basic flow fields in terms of the temperature gradients only. After discretization, we formulate approximated sufficient finite-difference formulas to evaluate the velocity field using the experimental data. Furthermore, this algorithm will lead to an accurate evaluation. The basic properties and procedures of the algorithm are discussed in details.

Keywords: Free convective heat transfer, Isothermal surface, Numerical Analysis, Natural Convection, Fluid Mechanics, Streamline Coordinates.