

**Marie Skłodowska-Curie Doctoral Candidate Position DC11 on
“AI-aided topology optimization of phononic crystals”
within the
MetacMed Doctoral Network**

Applications are invited from suitable qualified candidates for a full time, 36 months fixed-term position, as a Doctoral Candidate (DC) on the MetacMed Doctoral Network at the *Institute of Fluid-Flow Machinery, Polish Academy of Sciences, Fiszera 14 St, 80-231 Gdańsk, Poland*.

This position is DC11, which is one of 12 DCs being recruited as a part of a European-funded Marie Skłodowska-Curie Doctoral Network (DN) on ***Acoustic and mechanical metamaterials for biomedical and energy harvesting applications– ‘MetacMed’, GRANT-101119738***, see www.metacmed.eu.

The successful applicant will be enrolled on a PhD programme at the Tricity Doctoral School, Polish Academy of Sciences, and will work on the topic of “*AI-aided topology optimization of phononic crystals*” under the supervision of Dr Pawel Kudela, Prof. of the Institute of Fluid-Flow Machinery, Polish Academy of Sciences.

Two secondments at:

- CNRS, Lille, France, 3 months,
- University of Leeds, Leeds, UK, 3 months,

are foreseen for this position.

Only applicants who have not been resident in Poland for more than 12 months in the 36 months preceding the effective starting date of this contract are eligible for this position. Moreover, applicants must not have been awarded with a PhD at the effective starting date of this contract. Further information is detailed below.

The deadline for the application is 31st July 2024, 12:00 CET

MetacMed in a nutshell

MetacMed aims to link basic research on acoustic and mechanical metamaterials (MMs) to health and well-being issues. DCs will each consider ways in which human health can be improved using MMs, e.g. improvement in the resolution of biomedical ultrasound imaging for e.g. cancer diagnostics, the design of better spinal implants, monitoring of bone healing, and the use of insoles to aid human walking. Another area of interest is to develop MMs that can be used for energy harvesting, to better power e.g. medical devices, and reduce reliance on conventional power sources. These are all backed up by fundamental studies into the MMs themselves to provide the background to achieve these tasks. The balance of the network has thus been carefully considered in terms of basic science and applications, with input from industry in areas such as MMs fabrication and exploitation. Associated with the above is a strong set of training events and tailored secondment periods at both associated partners and beneficiaries.

Visit www.metacmed.eu for further information.

About the position and the research project

This full-time position will be available, subject to funding, from October 2024 and offered on a fixed-term 36-month contract. This post benefits from a highly competitive and attractive salary,

plus mobility and family allowances as applicable. Working as a part of the WP5 work package, the successful applicant will complete a research project on: “AI-aided topology optimization of phononic crystals”. The objectives of this project are:

- (i) Develop Deep Learning surrogate model for calculation of dispersion diagrams;
- (ii) Consider hierarchy and fractal patterns in the unit cell of phononic crystal;
- (iii) Propose a topology optimization framework by utilizing soft computing methods such as particle swarm optimization and genetic algorithm.

Research environment:

You stay in the beautiful city of Gdańsk located on the Baltic coast of northern Poland. Gdańsk is the capital and largest city of the Pomeranian Voivodeship. Gdańsk along with Sopot and Gdynia offer different vibes and ample opportunities for social, cultural, and outdoor activities. Together they form a metropolitan area called the Tricity (Trójmiasto) which is well-connected by public transport.

Institute of Fluid-Flow Machinery is a research institute founded in 1956 which belongs to the Polish Academy of Sciences a Polish state-sponsored institution of higher learning. You will be a part of an energetic and young team working at the Mechanics of Intelligent Structures Department already hosting multinational, multicultural PhD students. We are committed to increase the diversity of our team and encourage qualified people from all backgrounds and genders to apply for this position. You will have access to computing facilities as well as advanced equipment such as a scanning laser Doppler vibrometer.

Qualifications/Skills required:

Candidates will be required to meet the Marie Skłodowska-Curie Doctoral Researcher eligibility criteria(<https://marie-sklodowska-curie-actions.ec.europa.eu/>), and criteria specific to this project.

Requirements:

- At the effective starting date of this contract, applicants must not have been awarded with a PhD;
- At the effective starting date of this contract, applicants must not have resided in Poland for more than 12 months in the three years immediately before the appointment;
- A Master’s degree in Mechanical, Structural/Civil, Biomedical or Materials Engineering, Physics, or Computer Science (or related disciplines).
- An excellent track record of academic achievement;
- An experience through courses or prior professional activities with at least one of the following: machine learning, structural dynamics, numerical modelling techniques (finite element method), experimental methods in acoustics/guided waves;
- Programming skills;
- Previous experience with acoustic/mechanical metamaterials modelling, design, and characterization will be a plus;
- Have very good communication skills in English both written and verbal;
- Ability to and commitment to producing scientific outputs for publication in peer-reviewed journals;
- Evidence of ability to work independently and collaboratively within an international team;

- Highly motivated, with excellent organisation skills and with strong attention to detail and quality;
- Are willing to travel to attend secondments, training and academic events.

Additional assets are certificates related to AI, especially deep learning and skills related to deep learning frameworks such as Tensorflow, Pytorch, Keras, etc. Also, prizes, awards and distinctions of the candidate resulting from the carried out/academic activities research will be assessed.

Position Duties

- As a doctoral candidate in this project, you will work on numerical tools aiding in practical implementations of metamaterials for improved medical screening and treatment at ultrasonic frequencies. This will be achieved by combining soft-computing methods, AI, FEM, analytic and semi-analytic models to produce new, state-of-the-art MetaMaterials (MMs) designs.
- You will be evaluating the potential of various AI algorithms to optimise the discovery of novel acoustic and mechanical MM designs/properties starting from the FEM database of known MMs.
- You will investigate the behaviour of 2-dimensional and 3-dimensional unit cells concerning the propagation of guided waves and band gaps, using numerical methods.
- You will propose the topology optimization framework which will be used in collaboration with the University of Leeds for the design of metamaterial filters for harmonic imaging and validate them through experiments.

Salary: 28 764 € per annum plus a mobility allowance equal to 7 200 € per annum, and family allowances as applicable and in line with the EC rules for Marie Skłodowska-Curie Doctoral Networks. **Note that this is a gross salary, and it is subject to national taxation.**

Start date: This position is funded by Horizon Europe under the Marie Skłodowska-Curie Doctoral Network programme and is available from the 1st of October 2024 to the contract end date (36 months).

Continuing Professional Development/Training: Researchers at the **Institute of Fluid-Flow Machinery, Polish Academy of Sciences** are encouraged to avail of a range of training and development opportunities designed to support their personal career development plans. **The Institute of Fluid-Flow Machinery, Polish Academy of Sciences** provides continuing professional development supports for all researchers seeking to build their own career pathways either within or beyond academia.

For further information about the position please contact Dr Pawel Kudela at pk@imp.gda.pl and for information about the host institution's respective department visit our website <https://www.imp.gda.pl/en/o4/z1/>

HOW TO APPLY?

We look forward to receiving your application including:

- letter of motivation,
- CV including a list of publications (if any),
- diplomas with grade transcripts (courses with grades),
- copy of certificates, documentation of awards, etc.
- additional documents can be requested during recruitment process.

Please, send the requested documents to Pawel Kudela via pk@imp.gda.pl with the email subject "Metacmed doctoral candidate". You are kindly asked to fill also the [pre-application module](#) **sending the same documents in attachment.**

For informal inquiries, please contact Dr Stefano Laureti at info@metacmed.eu.

Closing date for receipt of applications is 12.00 am (Central European Time) on 31st July 2024. We reserve the right to re-advertise or extend the closing date for this post. It is anticipated that selected candidates will be further interviewed.

For further information please see the MetacMed Call for Applicants ([download here](#)) and have a look at the MetacMed website (www.metacmed.eu) to stay up-to-date!