

## Marie Skłodowska-Curie Doctoral Candidate Position DC5 on

### “Metamaterial enhanced ultrasonic guided wave monitoring for osseointegrated implants and fractured bone healing”

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, Fiszerza 14 St, 80-231 Gdańsk, Poland*.

This position is DC5, 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](http://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 “*Metamaterial enhanced ultrasonic guided wave monitoring for osseointegrated implants and fractured bone healing*” under the supervision of Prof Wiesław Ostachowicz (ORCID 0000-0002-8061-8614).

Three secondments at:

- CNRS, Lille, France, 5 months,
- Amazemet Sp. Z o.o., Warsaw, Poland, 3 months,
- OrthoSens, Switzerland, 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 are detailed below.

**The deadline for the application is 31<sup>st</sup> 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](http://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 WP7 work package, the successful applicant will complete a research project on: “Metamaterials for spinal implants and enhanced bone healing/monitoring”. The objectives of this project are:

- (i) Develop numerical tools for simulation of Guided Waves in bones and osseointegrated implants transmitted and registered by ultrasonic transducer;
- (ii) Investigate methods for ultrasonic transducer enhancement by Metamaterials matching layer;
- (iii) Perform feasibility studies of multi-mode QUS methods for fractured bone healing and osseointegrated implant monitoring.

### 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: structural dynamics, numerical modelling techniques (finite element method), experimental methods in acoustics/guided waves;
- Programming skills;
- Previous experience and/or knowledge about necessary medical/biomedical aspects in the subject will be a plus;



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- 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.

Also, prizes, awards and distinctions of the candidate resulting from the carried out research/academic activities will be assessed.

### Position Duties

- As a doctoral candidate in this project, you will develop numerical tools for simulation of GW in bones and osseointegrated implants transmitted and registered by ultrasonic transducer. You will conduct research training on numerical methods to solve wave equations through the finite element method and the time domain spectral element method.
- You will conduct training on MMs and PCs for acoustic and biomedical applications.
- You will design an acoustic MM integrated with ultrasound transducers for high quality broadband excitation and reception of ultrasound GW;
- You will perform feasibility studies of multi-mode quantitative ultrasound (QUS) methods for fractured bone healing and osseointegrated implant monitoring;
- You will be investigating methods for ultrasonic transducer enhancement by MMs matching layer. You will propose matching layer design in collaboration with CNRS (France)
- You will explore possibilities for Additive Manufacturing matching layer in collaboration with Amazet Sp. z o.o., Poland
- You will be evaluating potential GW monitoring of spinal MM devices in collaboration with OrthoSens SA, Switzerland

**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 Prof Wieslaw Ostachowicz at [wieslaw@imp.gda.pl](mailto:wieslaw@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 the recruitment process.

Please, send the requested documents to Wieslaw Ostachowicz via [wieslaw@imp.gda.pl](mailto:wieslaw@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](mailto:info@metacmed.eu).

Closing date for receipt of applications is 12.00 am (Central European Time) on 31<sup>st</sup> 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](http://www.metacmed.eu)) to stay up-to-date!