Decree of the Rector n. 1160 of 13/11/2023
Competition for awarding 1 research grant at the University of Udine

DISCLAIMER:
The official and legally binding call for applications is in Italian only.
This document cannot be used for legal purposes and is only meant to provide information in English on the call for applications (Decree of the Rector n. 1160 of 13/11/2023). Please refer to the official call published on: https://www.uniud.it/it/albo-ufficiale

Any change and integration will be made available on the above mentioned web page. Therefore, no personal written communication regarding the examination date and/or competition results shall be provided to applicants.

Annex 1

Competition announcement for the assignment of 1 research grant at the University of Udine, entitled "Mass identification in nanoplates from finite eigenvalue data" SSD: ICAR/08 (principal investigator, Antonino Morassi)

Research grant funded by the resources of the project PRIN 2022 - Prot. n. 2022JMSP2J

Art. 1

A selection procedure is hereby launched for the award of 1 research grant at the University of Udine, as identified in Attachment A which constitutes an integral part of the present announcement.
The research grant is linked to the research project and is subject and conditioned upon the relative funding.
The fellowship may be renewed, in compliance with Art. 22, Law No. 240 of 30 December 2010 (as in the text in force before the implementation of the Conversion Law of the D.L. 36/2022, L. 79/2022), Law No. 11 of 27 February 2015, and the current regulations of the University of Udine for awarding research grants, issued with the Rector's Decree No. 182 of 31 March 2021. The renewal is subject to the scientific coordinator's positive assessment of the researcher's activities, an adequate scientific rationale, and a corresponding financial covering.

The research fellowship does not give rise to any right with regards to accessing University posts.

Any personal communication to candidates related to this selection will be sent exclusively to the email address indicated when registering for the selection, as mentioned in Art. 5.

Art. 2

The research grant described in this competition announcement and the required qualifications to apply for the position are identified in Attachment A. The lack of the admission requirements leads to the automatic exclusion from the competition procedure.

Possession of a PhD or equivalent degree obtained abroad or, only for the interested areas, of a medical specialization accompanied by an adequate scientific production, constitutes a preferential qualification for awarding the research fellowship of this selection, if it has not been provided as a mandatory requirement.

For the only purpose of the admission to the competition, the Examining Board (Art. 7) shall assess the equivalence of the qualification obtained abroad, except for the evaluation of the medical specialization qualification to which Article 38 of the Legislative Decree 165/2001 and subsequent modifications and additions, and EU regulations on the matter, shall be applied.

The Examining Board will proceed to the evaluation of the qualification obtained abroad according to the documentation attached to the application form. The Examining Board may exclude the candidate if the submitted documentation does not provide sufficient information for the assessment.
Therefore, applicants must enclose all the documentation in their possession relating to their qualification in order to provide the Examining Board with sufficient information for assessment.

Candidates holding a qualification issued by a **European Research Area country**, if successful, must submit, if not already attached to the application form one of the following options:

- Supplement Diploma in English issued by the competent University.
- CIMEA Certificate of comparability of the foreign qualification, issued by CIMEA (Information Centre on Academic Mobility and Equivalence) via the "diplo*me*" service at https://cimea.diplo-me.eu/udine/#/auth/login

Candidates holding a qualification issued by a **non-European Research Area country**, if successful, must submit, if not already attached to the application form one of the following options:

- Declaration of the on-site value of the qualification and the certificate relating to the degree with examinations and grades. A certificate in a language other than Italian or English must be accompanied by an official translation into one of these languages (certified by the competent diplomatic-consular authority or certified by a court in Italy).
- CIMEA Certificate of comparability of the foreign qualification, issued by CIMEA (Information Centre on Academic Mobility and Equivalence) via the "diplo*me*" service at https://cimea.diplo-me.eu/udine/#/auth/login

If the Supplement Diploma or the statement/attestation of comparability are not available when signing the contract, the applicant must demonstrate that he/she has requested the documentation and submit it as soon as possible.

Any exclusion from the selection procedure due to lack of eligibility requirements, absence of required documents, failure to sign the selection application or submission of the selection application in a manner different from what is provided for in this call for applications will be communicated to applicants exclusively at the email address indicated in the application form.

Art. 3

The research grant referred to in this call for applications cannot be awarded:

a. to employees of Universities and the entities referred to in Article 22, section 1, of Italian Law no. 240 of 30 December 2010 (in the text prior to the reform introduced by Law no. 79 of 29 June 2022);
b. to those who have already been awarded research grants pursuant to Italian Law no. 240 of 30 December 2010 (prior to the reform introduced by Law no. 79 of 29 June 2022) for the maximum period provided by law, even if not continuously, excluding the period in which the grant was used in conjunction with the doctorate, up to the legal term of the relative course;
c. to those who have already benefited from research grants and fixed-term researcher contracts provided for, respectively, in Articles 22 and 24 of Italian Law no. 240 of 30 December 2010 (in the text prior to the reform introduced by Law no. 79 of 29 June 2022), for a total of 12 years, even if not consecutive;

d. to anyone who has a degree of kinship or affinity, up to and including the fourth degree, with:
   - the Rector, the Director General or a member of the Board of Directors of the University of Udine;
   - the scientific supervisor or a professor/researcher belonging to the department or organisation hosting the research grant in question.

The research grant provided for in this call for applications cannot be combined:

a) with scholarships of any kind, except for those granted by Italian or foreign institutions to supplement, by means of stays abroad, the fellow's training or research activities;
b) with other research grants;
c) with an employment relationship, even if part-time, without prejudice to the relevant provisions for employees of public administrations.

The grant awarded under this call for applications is also incompatible with simultaneous attendance at university degree courses, either Bachelor's degree or Master's degree courses, research Doctorates with scholarships and medical specializations, in Italy or abroad.

Art. 4

Applicants must enclose with their application, under penalty of exclusion, the following documents:

a) their professional scientific CV, highlighting the candidate's aptitude for carrying out and implementing the research project (Attachment A);
b) their identity card, their passport or any other identification document[1];
c) (for candidates with a foreign qualification only) certification or self-certification of both the academic qualification required for the admission to the selection, and of the exams (with evaluation) took during the period of study abroad, and of any other document that can be useful to the evaluation of the degree by the Examining Board.

Applicants can attach to the application, publications and any other certification considered useful to demonstrate the qualification based on the research program (Attachment A) and to certify any research activity accomplished at public or private institutes (indicating the starting and ending date and the duration).

The documents and qualifications mentioned above must be submitted in Italian or English. Those that are not as requested will not be evaluated. Documents originally written in a language other than Italian or English must come with a translation in Italian or English, that the candidate will do on its own responsibility. The translation can be an abstract concerning the thesis.

Italian and Community candidates wishing to submit qualifications referring to conditions and facts attested by Public Administrations must proceed exclusively with self-certification.
Non-EU citizens legally residing in Italy may self-certify only data that can be verified or certified by Italian public bodies. They may also use declarations in lieu when provided for by an international convention between Italy and the declarant's country of origin.
Non-EU citizens not residing in Italy cannot self-certify.

Only the qualifications possessed by the candidate on the date the application form is submitted and submitted in accordance with the procedures set out in Article 5 will be assessed.

[1] Please be aware that the residence permit is not an identification document.

Failure to submit mandatory documents provided for in this article will constitute grounds for exclusion from the selection.

Art. 5

The submission of the applications for the present call starts on November 23, 2023 at 2:00 pm (Italian time) and ends on December 7, 2023 at 2:00 pm (Italian time).

The application to take part in the selection must be completed, under penalty of exclusion, using the appropriate online procedure, available at the link https://pica.cineca.it/
The procedure involves an applicant registration step, for those who do not already have an account, and then an application completion step.

Once completed, the online application must be signed in the manner described in the online procedure (manual signature with attached identity document or digital signature), under penalty of exclusion from selection. The application does not have to be signed if you access the above-mentioned online procedure using your SPID ID.

The qualifications referred to in Article 4 must be attached to the application in .pdf format. Individual .pdf files may not exceed 30MB.

The application for participation in the selection is automatically sent to the University of Udine with the definitive closing of the online procedure.

The University Administration:
- is not responsible if it is impossible to read the submitted documentation in electronic format due to damaged files;
- shall not accept or take into consideration qualifications or documents received in paper form or by any means other than what is specified in this article.

Reference to documents or publications already submitted in connection with other competitions is not allowed.

The Administration is not responsible for any missing document or communication because of inaccurate indication of residence and/or address submitted by the candidate during the application. Also, the Administration is not responsible if the candidate has not communicated changes in this information, or has communicated them too late. The Administration is also not responsible for any postal or telegraphic problems not attributable to the Administration itself.

Applicants are advised not to wait until the last few days before the closing date to submit their application. The University accepts no responsibility for any malfunctions due to technical problems and/or overloading of the communication line and/or application systems.

Art. 6

The selection procedure is held in accordance with the modality indicated in Attachment A.

The test will aim to assess the general preparation, experience and aptitude for research of the candidate. It will consist in the evaluation of the professional scientific curriculum, of the publications and qualifications presented, and of the interview, where foreseen.

Art. 7

The Examining board for the competition is identified in Attachment A of the present competition announcement, of which it is an integral part.

At its first meeting, the Examining board shall appoint its President and Secretary, and establish the criteria and methods for evaluating the qualifications and the interview, where foreseen.

The results of the qualifications assessment must be disclosed to applicants during the interview, where foreseen.

The Examining board can award a maximum of 100 points (one hundred out of one hundred) to the selection.

At the end of the evaluation procedure, the Examining board shall formulate the general merit list based on the overall score of each candidate, and draw up the minutes of the whole competition procedure.

Based on the ranking list, the assignment is awarded to candidates who have obtained a minimum overall score of 70/100 (seventy out of one hundred).

The Examining board's judgement is final.

The ranking list will be made public exclusively through publication on the University's official website.

Applicants will not be notified of the outcome of the evaluation.

Those who do not declare their acceptance of the research grant and do not present themselves at the research centre within the deadline communicated by the latter, even if not formally, shall lose the right to receive it. Exceptions to this term will only be granted in cases of documented force majeure.

Art. 8

The research activity cannot be started before signing the contract defining the terms and conditions of the collaboration.

The activity covered by the research grant must have the following characteristics:

a) it must be carried out as part of the research programme covered by the grant and not be a merely technical support to it;
b) it must have a close connection with the realization of the research program for which the winner of the grant has been awarded the contract;
c) it must be continuous and, in any case, temporally defined, not merely occasional, and in coordination with the overall activity of the University;
d) it must be carried out autonomously, solely within the limits of the programme prepared by the programme supervisor, without predetermined working hours.

The researcher is required to submit a detailed written report on the work carried out and the results achieved, accompanied by the opinion of the scientific supervisor, to the reference organisation at the intervals set out in the contract. The researcher must also submit interim reports and timesheets, if requested by the reference organisation.

Either the fellow or the reference organisation may withdraw from the contract.

The reference organisation may terminate the contract not only in the cases referred to in Article 9, sections 2 and 3, of the "Internal rules for awarding research grants pursuant to law 240 of 30 December 2010" of the University of Udine, but also in the event the research project and therefore the financial coverage on which the research grant is based cease to exist.

Art. 9

The following legal dispositions shall apply to the grant referred to in this call for applications:
- for tax matters, the provisions of Article 4 of Italian Law no. 476 of 13 August 1984, as subsequently amended and supplemented;
- for social security matters, the provisions of Article 2(26) *et seq*. of Italian Law no. 335 of 8 August 1995, as subsequently amended and supplemented;
- for mandatory maternity leave, the provisions of the Italian Ministerial Decree of 12 July 2007;
- with regard to sick leave, the provisions of Article 1(788) of Italian Law no. 296 of 27 December 2006 and subsequent amendments.

During the period of mandatory maternity leave, the allowance paid by INPS according to Art. 5 of the Italian Ministerial Decree of 12 July 2007 is supplemented by the University up to the full amount of the research grant.

The grant will be paid in monthly instalments.

Art. 10

The data collected as part of the procedure referred to in Art. 5 are necessary to properly manage the selection procedure, for any subsequent management of the research grant and for purposes related to managing services provided by the University. The University of Udine is the Data Controller. At any time, the data subject may request access, rectification and, depending on the University's institutional purposes, cancellation and restriction of processing or oppose the processing of their data. The data subject can always lodge a complaint with the Italian Data Protection Authority. The complete disclosure is available on the University of Udine website in the "Privacy" section, accessible from the home page www.uniud.it Direct Link: https://www.uniud.it/it/it/pagine-speciali/guida/privacy

Art. 11

For all matters not expressly mentioned in this call for applications, refer to the regulations in force on the subject cited in the introduction and to the "Internal rules for awarding research grants pursuant to Italian Law no. 240 of 30 December 2010" of the University of Udine, issued by Rector's Decree no. 182 of 31 March 2021.

Art. 12

The procedure supervisor is Dr Sandra Salvador, Head of the Research Services Area of the University of Udine.

The Responsible office at the University of Udine is “Area Servizi per la Ricerca - Ufficio Formazione per la Ricerca”, via Mantica n. 31 - 33100 Udine, Italia.

To request information about the call for applications, please complete the following form available on the University of Udine website:
https://helpdesk.uniud.it/SubmitSR.jsp?type=req&accountId=universityofudine&populateSR_id=42105

Attachment A

Responsabile scientifico della ricerca / Principal investigator:

Nome e cognome / Name and surname: Antonino Morassi
Qualifica / Position: Professore Ordinario / Full Professor
Dipartimento / Department: Politecnico di Ingegneria e Architettura (DPIA) / Polytechnic of Engineering and Architecture
Area MUR / Research field: 08 - Ingegneria civile e architettura
Settore concorsuale e Settore scientifico disciplinare / Scientific sector: 08/B2; ICAR/08 - Scienza delle costruzioni

Titolo dell'assegno di ricerca / Topic of the research fellowship "assegno di ricerca":
I bandi sono consultabili dal sito dell'Ateneo, del MUR e di Euraxess / The calls are available on the University, MUR and Euraxess websites

Testo in italiano:

Identificazione della densità di massa in nanopiastre da dati spettrali finiti.

Text in English:

Mass identification in nanoplates from finite eigenvalue data.

Obiettivi previsti e risultati attesi del programma di ricerca in cui si colloca l'attività dell'assegnista di ricerca / Foreseen objectives and results of the research programme performed by the research fellow "assegnista di ricerca":
I bandi sono consultabili dal sito dell'Ateneo, del MUR e di Euraxess / The calls are available on the University, MUR and Euraxess websites

Testo in italiano:

Lo studio dei nanosensori sta attirando un interesse crescente nella comunità scientifica internazionale per la necessità di misurare in maniera sempre più accurata proprietà fisiche e chimiche in sistemi industriali o biologici alla scala submicronica. Il miglioramento delle tecniche di produzione dell'ultimo decennio ha portato a una riduzione significativa delle dimensioni dei sistemi nano-elettro-meccanici, con progressi notevoli nei costi di fabbricazione, nel consumo energetico e nell'integrazione di questi dispositivi in altre tecnologie. Le dimensioni estremamente ridotte di questi trasduttori hanno reso possibili nuove metodologie di rilevamento e prestazioni migliorate, con un impatto significativo su una ampia varietà di applicazioni tecnologiche.

Uno degli esempi più rappresentativi dei vantaggi del "downscaling" nei sistemi di sensori è il risonatore nanomeccanico, che consiste in un sistema vibrante con prestazioni estremamente spinte nella identificazione di masse aderenti che producono lievi variazioni delle frequenze di risonanza. Questi sensori mostrano un'elevata sensibilità e precisione di misura per varie ragioni: tra queste, la loro massa ridotta, fattori di dissipazione energetica molto contenuti e un rapporto segnale/rumore elevato. La miniaturizzazione dei risonatori ha migliorato la risoluzione del rilevamento di massa dal picogrammo allo zeptogrammo in meno di un decennio.

In questa ricerca si prevede di utilizzare le nanopiastre come sensori di massa e i metodi inversi basati sulle vibrazioni come tecniche di identificazione. Sebbene sia meno diffusa delle nanotravi, la tipologia delle nanopiastre presenta alcuni vantaggi meccanici intrinseci, come la robustezza, che è una caratteristica rilevante per la produzione e la funzionalizzazione, e la maggiore rigidità, che si traduce in frequenze più elevate e quindi in fattori di qualità più alti. Risultati sperimentali ormai consolidati mostrano che la modellazione di nanopiastre richiede una generalizzazione delle nozioni tipiche della meccanica del continuo classica per tener conto degli effetti dimensionali e di scala del problema. A questo proposito, per la modellazione meccanica ci si appoggerà su alcune teorie recenti che

estendono le teorie classiche delle piastre e tengono conto, per esempio, degli effetti di secondo gradiente nella definizione dell'energia del sistema.

Il progetto si concentrerà principalmente su una classe specifica di problemi inversi per nanopiastre, vale a dire l'identificazione di piccole masse aggiunte a una configurazione di riferimento supposta nota. Il principio del rilevamento della massa si basa sulla misura delle variazioni causate dall'aggiunta di massa in un numero finito di prime frequenze di risonanza. In letteratura sono disponibili pochi risultati generali per questa classe di problemi inversi con numero finito di autovalori. La principale difficoltà teorica è legata alla non unicità della soluzione e alla necessità di determinare, o almeno di approssimare, la topologia più debole per il coefficiente di massa che garantisce la continuità degli autovalori. Il gruppo di ricerca ha condotto negli ultimi anni uno studio quantitativo sull'identificazione della massa aggiunta in nanotravi. In questo progetto di ricerca si prevede di estendere lo studio del problema inverso al caso bidimensionale dei sensori di massa costituiti da nanopiastre. In una prima fase verrà considerata l'identificazione di una perturbazione regolare e doppiamente simmetrica in una nanopiastra rettangolare con bordo appoggiato. Il metodo di identificazione che si intende applicare si basa sulla determinazione di una famiglia di coefficienti di Fourier generalizzati della variazione della densità di massa valutata su un'opportuna base di funzioni, che viene suggerita in maniera naturale dall'espansione di Taylor degli autovalori linearizzata in un intorno della nanopiastra di riferimento. In un secondo momento, si prevede di rimuovere l'ipotesi di simmetria e di generalizzare la metodologia di identificazione con l'impiego di informazioni spettrali che provengono da condizioni al contorno differenti. Il programma di ricerca comprende anche l'analisi di nanopiastre di forma più generale e lo sviluppo di un codice numerico per il problema diretto e inverso agli autovalori.

I risultati della ricerca permetteranno di progredire nella conoscenza dei problemi inversi con numero finito di autovalori per le nanopiastre e costituiranno una base importante per lo studio di problemi analoghi per le nanostrutture bidimensionali con curvatura iniziale.

Text in English:

Nanosensors are gathering attention in the last years due to the necessity of measuring physical and chemical properties in industrial or biological systems in the submicron scale. In the last decade, the improvement in manufacturing techniques gave rise to a size reduction of nano-electro-mechanical systems, resulting in remarkable advances in fabrication costs, power consumption and integration. The reduced dimensions of these transducers lead to novel sensing concepts and to an enhanced performance with a great impact on a diversity of applications.

One of the most representative examples of the advantages of downscaling in sensoring systems is the nanomechanical resonator, which consists in a vibrating structure with remarkable performance in detecting small adherent masses which produce slight changes in the resonant frequencies of the system. These label-free sensors show high sensitivity and measurement precision for several reasons: low mass, high quality factor, and high signal-to-noise ratios. Miniaturization of these resonators has moved the resolution of mass detection from the picogram to the zeptogram range in less than a decade.

Among the several types of nanosensors in this research we will consider the nanoplates and the vibration-based methods as identification techniques. Although less prevalent than nanobeams, the plate typology presents some inherent mechanical advantages such as robustness, which is a relevant feature for manufacturing and functionalization, and higher stiffness, which results in higher frequencies and therefore higher quality factors. The modelling of nanoplates presents specific requirements due to the presence of size effects, even pointed out by experimental results, related to the scale of the problem. In this regard, generalized continuum mechanics theories, such as the strain gradient theories, will be preferred to molecular dynamic-based approaches, to model the vibrational behaviour of the nanoplates, in reason of their reduced computational cost.

The project will be mainly focussed on a specific class of inverse problems in vibration for nanoplates, namely the identification of small adherent masses added to a referential configuration of a nanoplate. The mass sensing principle is based on using the resonant frequency shifts caused by the unknown

additional mass as dynamic eigenvalue data for reconstructing the mass variation. Very few general results are available for this class of inverse eigenvalue problems with finite data. The main theoretical difficulty is related with the non-uniqueness of the solution and the need of determining, or at least of approximating, the weakest topology of the unknown mass coefficient with respect to which the eigenvalues are continuous functions. A first quantitative study of the identification of distributed mass attached on vibrating nanobeams has been performed by the research group in the past years. Within the present research proposal, it is planned to extend the study of the mass identification problem to a nanoplate mass sensor. First, the identification of doubly symmetrical mass distribution, smooth and small, in a supported rectangular nanoplate will be considered. The identification method that is intended to be applied is based on determining a set of generalized Fourier coefficients of the mass density change evaluated on a suitable basis of functions, which naturally arises from the linearized Taylor expansion of the eigenvalues in a neighbourhood of the referential nanoplate. In a second step, it is planned to show how the addition of sets of eigenvalues corresponding to different boundary conditions can be useful for the determination of mass densities either with one symmetry only or without symmetry. The research program also includes the analysis of nanoplates with more general mid-plane shape and the development of a numerical code for the direct and the inverse eigenvalue problem.

The outcomes of the research will allow to advance in the knowledge of the finite eigenvalue problems for nanoplates, and will constitute an important basis for studying analogous problems for nanoplates with initial curvature (nanoshells).

Struttura dell'Università di Udine presso la quale verrà sviluppata l'attività di ricerca / Department or other structure of the University of Udine where research activities will be carried out:

Dipartimento Politecnico di Ingegneria e Architettura (DPIA) / Polytechnic Department of Engineering and Architecture

Importo dell'assegno di ricerca (al lordo oneri carico assegnista) / Total grant gross for the research fellowship:

€ 19.456,00

Durata dell'assegno di ricerca / Duration of the research fellowship "assegno di ricerca":

12 mesi / months

Finanziamento / Financed by:

La copertura finanziaria graverà sul progetto PRIN 2022 – "Stability and stress analysis in statics and dynamics of innovative structural and material coupled systems"; Prot. n. 2022JMSP2J. Decreto di finanziamento n. 973 del 30/06/2023 - Settore PE1. Codice CUP G53D23001820006. Ministero dell'Università e della Ricerca (Finanziato dall'Unione Europea, NextGenerationEU).

Requisiti di ammissione / Minimum qualifications necessary:

- Possesso del titolo di Dottore di ricerca o titolo equivalente conseguito all'estero;
- possesso di un curriculum scientifico professionale idoneo allo svolgimento dell'attività di ricerca contemplata.

- Research doctorate or equivalent qualification obtained abroad;
- professional scientific curriculum suitable for the research activity above mentioned.

Procedura selettiva / Competition procedure:

Valutazione per soli titoli / Assessment of qualifications only

Commissione giudicatrice / Examining Board:

Nome e Cognome	Qualifica	SSD	Università
Membri Effettivi / Permanent members			
Daniele Goi	PO	ICAR/03	Università degli Studi di Udine
Eric Puntel	PA	ICAR/08	Università degli Studi di Udine
Matteo Brunetti	RTD	ICAR/08	Università degli Studi di Udine
Membro Supplente / Temporary member			
Matteo Nicolini	RU	ICAR/02	Università degli Studi di Udine