POLITECNICO DI MILANO

PhD in BIOINGEGNERIA / BIOENGINEERING - 38th cycle

PNRR_352 Research Field: CALIBRATION OF A COMPUTATIONAL MODEL FOR THE ESTIMATE OF CARDIAC BLOOD FLOW MAPS

Monthly net income of PhDscholarship (max 36 months)
€ 1250.0 In case of a change of the welfare rates during the three-year period, the amount could be modified.

Context of the research activity	
Motivation and objectives of the research in this field	The cardiac muscular tissue (myocardium) requires continuous oxygen supply to properly work, i.e. to contract and pump the blood into the whole arterial system. Numerical simulation can in principle provide meaningful quantitative information about myocardial perfusion, both in physiological and in pathological conditions. The goal of the research project is to develop a computational tool to estimate myocardial perfusion. The core of the activity will be the calibration of the model in order to make patient-specific the analysis and to provide an alternative to stress-CT acquisitions.
Methods and techniques that will be developed and used to carry out the research	The project will use the Finite Elements for Navier-Stokes and Darcy problems for the modeling of the cardiac pefusion. It will also employ image reconstruction techniques to obtain the computational domains and Machine learning and optimization for the model calibration.
Educational objectives	The educational objectives will consist in achieving in-depth knowledge of the fluid dynamics and imaging techniques for the heart wall as well as in developing the related computational tools. General educational activities of the PhD student will be aligned with the School roles.

Job opportunities	This experience will allow the PhD student to have expertise in the field of cardiovascular therapies and computational tools. This could be useful both in engineering companies which make use of computational tools and as an engineer to assist in hospitals physicians in the use of different technology in the field of cardiovascular diseases.
Composition of the research group	1 Full Professors 0 Associated Professors 1 Assistant Professors 1 PhD Students
Name of the research directors	Prof. Christian Vergara

Contacts
Prof. Christian Vergara Phone: +39.02.239.94778 Email: christian.vergara@polimi.it http://www1.mate.polimi.it/~vergara/

Additional support - Financial aid per PhD student per year (gross amount)	
Housing - Foreign Students	--
Housing - Out-of-town residents (more than 80Km out of Milano)	--

Scholarship Increase for a period abroad	
Amount monthly	625.0 €
By number of months	6

National Operational Program for Research and Innovation	
Company where the candidate will attend the stage (name and brief description)	Bracco Group; www.bracco.com/en
By number of months at the company	6
Institution or company where the candidate will spend the period abroad (name and brief description)	Eindhoven University of Technology; www.tue.nl/en
By number of months abroad	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information

Attinenza alla tematiche, alle missioni/componenti prescelte del bando PNRR ex D.M. 352, art.6

La tematica della borsa, cioè lo sviluppo di un tool per la predizione computazionale delle mappe

di perfusione cardiaca in soggetti umani, è di grande interesse sia per la Missione 6 - Salute del PNRR, perché permetterà di valutare l'apporto (eventualmente insufficiente) di ossigeno nel miocardio individuando le regioni dello stesso non funzionanti correttamente, sia per la Missione 4 - Istruzione e ricerca, M4C2 - Dalla ricerca all'impresa, perché i metodi sviluppati potranno essere alla base delle applicazioni di Bracco nel campo dei mezzi di contrasto per imaging cardiaco TAC.

Impresa, presso cui si svolgerà l'attività esterna
Bracco Group
 settore attività: Salute
link alla pagina dell'ente, università, azienda, centro di ricerca: www.bracco.com/en
numero di mesi previsti: 6
Descrizione sintetica attività:
Bracco si occuperà dell'analisi del mezzo di contrasto necessario per effettuare le analisi CT.

Ente, università, azienda, centro di ricerca presso cui si svolgerà il periodo di studio e ricerca all'estero
Eindhoven University of Technology
settore attività: ricerca su effetti di interfaccia, perfusione sanguigna, poro e biomeccanica
link: www.tue.nl/en
numero di mesi previsti: 6
Descrizione sintetica attività:
L'attività sarà presso il Dip. di Mechanical Engineering, prof Huyghe, esperto di modelli per la perfusione cardiaca. La collaborazione prevede che si utilizzino i modelli cast da loro sviluppati per la calibrazione del nostro modello

A shared desk and a PC will be given to the student for the time needed to carry out research. A limited budget will be available for travelling and purchases, too.