



PhD in BIOINGEGNERIA / BIOENGINEERING - 39th cycle

THEMATIC Research Field: MACHINE LEARNING FOR FLUID-STRUCTURE INTERACTION IN CARDIOVASCULAR PROBLEMS

Monthly net income of PhDscholarship (max 36 months)

€ 1400.0

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 project aims at developing novel methods in the emerging field of Scientific Machine Learning, a discipline where numerical methods in Scientific Computing and algorithms of Machine Learning (ML) combine to deliver fast and accurate approximations of problems described by Partial Differential Equations. In particular, we are interested here in the Fluid-Structure Interaction (FSI) problem arising in the context of hemodynamics, where blood interacts with the arterial vessel wall. This problem is often relevant for clinical analyses, since blood plays a major role in determining the conditions which may lead to pathologies (such as atherosclerosis) and which regulate the good efficacy of therapies and devices.

Methods and techniques that will be developed and used to carry out the research

The use of stable loosely-coupled (LC) schemes for the solution of CV-FSI problems is very attractive, mainly for two reasons: first, they allow for using pre-existing fluid and structure codes without the need of implement ad hoc FSI codes; second, they guarantee in general a fast solution since only one fluid and one structure problems are solved per time step, provided that the time discretization parameter needed to achieve stability is not too small in comparison with the accuracy needs. Here we try to merge the effectiveness of LC schemes with ML techniques

Educational objectives

The PhD student will develop knowledge in the field of



	computational tools for cardiovascular problems, in particular for fluid-structure interaction problems, as well as in the field of Scientific Machine Learning
Job opportunities	The knowledge acquired during the project will allow the student to be ready for jobs in the field of computational research as well as for engineering tasks within hospitals.
Composition of the research group	1 Full Professors 0 Associated Professors 1 Assistant Professors 1 PhD Students
Name of the research directors	CHRISTIAN VERGARA

Contacts
<i>Prof. Christian Vergara</i> <i>christian.vergara@polimi.it</i>

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	700.0 €
By number of months	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information
<p>The knowledge of the Finite Elements library LIFEX will be fundamental in view of the achievement of the objectives of the project. Biomedical and Mathematical Engineering will be suited for the project, in particular with experiences on the approximation of cardiovascular mathematical problems.</p> <p>The PhD student will be involved in educational activities along with teaching assistantship covering topics of imaging in small animal models and bioengineering of the respiratory system. A shared desk and computer will be given to the student for the time needed to carry out the research.</p>