POLITECNICO DI MILANO

PhD in SCIENZE E TECNOLOGIE ENERGETICHE E NUCLEARI / ENERGY AND NUCLEAR SCIENCE AND TECHNOLOGY - 41st cycle

THEMATIC Research Field: BUBBLE COLUMN FLUID DYNAMICS: A MULTI-SCALE PERSPECTIVE FOR FLOW REGIMES AND SCALING-UP PURPOSES

Monthly net income of PhDscholarship (max 36 months)
1700.0 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	**Bando a valere sul fondo FIS2 (Decreto Direttoriale n. 1236 del 1-8-2023), progetto AURIGA, Codice progetto FIS-2023-00204, CUP D53C25000730001** Bubble columns are gas-liquid reactors widely used in the chemical industry due to their ease of operation, minimal maintenance requirements and excellent heat and mass transfer between phases. Despite the simple bubble column design (a vertical vessel with a gas distributor at the bottom), the fluid dynamics involved is extremely complex. Phenomena at different scales (i.e., bubble scale and reactor scale) influence the flow regimes and the flow regime transitions. Unfortunately, the physics and the phenomena behind the multi-scale connections are not completely understood. This research aims to bridge this gap. Objectives of the research are: •Develop a comprehensive theory for characterizing flow regimes and detecting flow regime transitions based on local (bubble size distributions, local void fraction profiles, pressure fluctuations) and global (global gas holdup) flow properties. •Understand and model the influence of fluid properties

	and column geometric characteristics on flow regimes and flow regime transitions. •Develop an input-output model which, given the fluid properties and column geometric characteristics, gives as output the existing flow regimes and their fluid dynamic properties. •To disseminate the findings broadly to the industrial and academic communities, fostering the adoption of best practices and informing future research direction
Methods and techniques that will be developed and used to carry out the research	The aim of this PhD project is to develop a comprehensive theory for flow regimes and flow regime transitions for two phase bubble columns. The expected tools to be used during the research are: **Theoretical tools**: Statistical analysis, Machine Learning, … **Computational tools**: Matlab, Python, ANSYS Fluent,…
Educational objectives	In general, this activity aims to promote interdisciplinary collaboration, develop critical thinking, and advance research skills. In particular, the PhD candidate will acquire high-level skills and expertise in the field of fluid dynamics research. The presence of international collaborations will allow the student to interact with leading European and non-European institutions in this research area.
Job opportunities	Job opportunities for a successful PhD candidate include both industrial and academical research or specific job positions as Thermal-Fluid Engineer
Composition of the research group	2 Full Professors 4 Associated Professors 3 Assistant Professors 10 PhD Students
Name of the research directors	Giorgio Besagni

Contacts
Prof. Giorgio Besagni - giorgio.besagni@polimi.it

Additional support - Financial aid per PhD student per year (gross amount)	
Housing - Foreign Students	--
Housing - Out-of-town residents	--

Scholarship Increase for a period abroad	
Amount monthly	850.0 €
By number of months	6

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

Educational activities: Financial aid per PhD student is available for purchase of study books and material, funding for participation in courses, summer schools, workshops and conferences, instrumentations and computer, etc. This amount is equal to 10% of the annual gross amount, for 3 years.

Teaching assistantship: Availability of funding in recognition of supporting teaching activities by the PhD student. There are various forms of financial aid for activities of support to the teaching practice. The PhD student is encouraged to take part in these activities, within the limits allowed by the regulations.

Computer availability: individual use.

Desk availability: individual use.