Da restituire compilata in lingua inglese, in formato word

PhD in Energetics

Research Title: Tool-chains for performance based design and operation of transparent adaptive facades

Funded by	EURAC Research

Supervisors	Internal: Prof. Marco Perino, DENERG – marco.perino@polito.it Dr. Fabio Favoino, DENERG – fabio.favoino@polito.it External: Dr. Stefano Avesani, EURAC-stefano.avesani@eurac.edu

Contact	TEBE research group - http://www.tebe.polito.it/ EURAC - http://www.eurac.edu/en/research/technologies/renewableenergy/researchfields/Pages/Energy-management-in-buildings.aspx

Context of the research activity	Adaptive transparent façades, through the use of different kind of adaptive components (e.g. shading systems, switchable glazings, etc.) are typical devices used to control the solar radiation gain inside buildings with the aim to reduce energy consumption and improve the occupant' internal comfort. Therefore, a correct performance characterization of such systems, via modeling and measuring, is important to properly evaluate how the façade performance affects the indoor environment. This evaluation methods can be used to guide decision making in the context of product development itself, as well as proper building integration of such a component, including its operations. The PhD project is funded by EURAC research, which is a research center that is working with industry to develop façade technologies in the context of private funded research, regional, national and European projects. The Technology Energy Building Environment (TEBE) research group worked together with EURAC on this subject, developing previous knowledge, methodologies, experimental facilities and industrial contact, that would be the starting point of this PhD project.

Objectives	The main objective of the PhD project is the development of a functional and performance evaluation approach and tool-chain for supporting the enhancement of transparent adaptive facade system technology concepts. The PhD aims at: • Critical analysis of the current methodologies to evaluate the performance of adaptive facades enabling the active control of solar gains in buildings, together with current standards related to building energy performance and IEQ, with the aim to propose possible improvement to take into account the peculiar features of dynamic/adaptive façade.

Da restituire compilata in lingua inglese, in formato word

	• Defining a reliable evaluation chain (toolchain) in a well-structured methodological framework, including both modelling and measuring procedures, for the analysis, performance and functional characterization of complex components and systems to control solar gain. • Supporting the design and the building integrated operations of innovative adaptive façade components and systems through the developed toolchain. • Supporting the development of suitable metrics able to characterize the adaptivity of the system as well as its compliance with the legislative framework in force The research is oriented to promote the use of advanced toolchain in design, manufacturing and implementation practice. The modelling and measuring activities are interconnected and supported by specific measurement activities and equipment in the outdoor façade testing facilities of PoliTO and EURAC research. The research project involves modelling and measurement activity of dynamic complex façade systems concepts, which could be provided by relevant industry partners of the two institutions. The performance and functional assessment toolchain will enable to support the industrial partners in the improvement of technology concepts, towards high TRL (Technology Readiness Level). The façade system performance will be evaluated considering both thermal and optical aspects. The PhD project, developed together with the industrial partner EURAC, will involve research activities at both institutions, therefore it is foreseen a physical presence of the PhD student alternated between PoliTO and EURAC.

Skills and competencies for the development of the activity	• Master degree preferably in Engineering (Energetics, Building, Civil) • Knowledge about building physics, indoor environmental quality (i.e. thermal and visual comfort) and building performance • Skills with dynamic energy simulation software (i.e. EnergyPlus, TRNSYS etc.) and daylighting simulations (i.e. DAYSIM, Radiance etc.) • Skills on data elaboration and programming (i.e. Python, C#, Matlab, R, etc.) • Additional experimental skills will be evaluated positively (i.e. design and implementation of data acquisition system, on-site measurement on building indoor physical parameters and building envelope characteristics)