Czech Technical University in Prague

UCEEB – University Center for Energy Efficient Buildings

Department of Architecture and interaction of buildings with the environment and
High performance building materials and structures

Faculty of Civil Engineering Department of Building Structures and Department of Steel and Timber Structures

Vacancies: UCEEB Postdocs

Announcement

The Czech Technical University in Prague - University Center for Energy Efficient Buildings (UCEEB) offers **post-doctoral positions** in the field of sustainable building, fire design and timber structures.

Start date: September 2013

Contract duration: 30 months (with a critical evaluation after the first year)

Deadline for applications: 29 April 2013; 25 May 2013 and 25 Aug 2013.

UCEEB in brief

Launched in October 2012, UCEEB is a newly established joint project of five faculties of the Czech Technical University in Prague. The mission of the Center is to perform high-level interdisciplinary research in the field of energy savings in buildings, utilizing a simulation- based engineering approach. The theoretical research activities will be systematically complemented with experimental validation, performed in a full-scale setting. This will provide unique data on materials, structures, and systems of intelligent control, including on their impact on the built and natural environment.

Project organization

The present project integrates seven different **topics** aligned with the research activities of UCEEB. Each topic will be supervised by a **mentor** from the Faculty of Civil Engineering of the Czech Technical University in Prague, with long-term experience in the relevant fields of research. The project is supported by the European Union.

The mentors involved in the project are

Petr Hájek (full professor; Petr.Hajek@fsv.cvut.cz), an expert in sustainable building construction, material-efficient structures and sustainable concrete.

Jan Tywoniak (full professor; Jan.Tywoniak@fsv.cvut.cz), and expert in building physics and energy efficient buildings.

František Wald (full professor, Wald@fsv.cvut.cz), an expert in the fire design, steel and aluminum structures, in charge of European network COST IFER; and European Erasmus Master program SUSCOS M.

Petr Kuklík (associate professor, Pert.Kuklik@fsv.cvut.cz an expert in the timber structures.

Research topics

Utilisation of ultra high performance silicate composites in façade panels for sustainable buildings
The aim of a research project is to optimize high performance silicate composites based on locally available materials and non-conventional reinforcement (textile and fibre reinforcement) for highly efficient application in integrated façade panels for energy efficient buildings. The focus will be on utilisation of ultra high performance concrete (UHPC) in combination with different types of fibres and/or textile 2D or 3D reinforcement. Important part of the research will be fixing system of subtle façade elements to frame structure. The work will focus on experimental and analytical investigation, and numerical simulation. It will cover (i) laboratory work on composite mix and its composition with textile and fibre reinforcement, (ii) verification of mechanical and other physical properties by testing, (iii) development of nonlinear FEM model for parametrical simulation and optimization, (iv) full scale testing of façade elements. Essential part will be optimization of composite mix as well as complex façade elements with respect to structural, environmental and economical criteria. The project is a part of wider research focus of the research team on sustainable building construction using high performance materials. Mentor: Prof. Hájek.

Studies on new generation of light-weight building envelope elements
The aim of a research project is to find an optimum solution for new generation of non lead-bearing light-weight prefabricated building envelope elements. One of the final visions is to develop a building envelope with partially changeable thermal performance, with the heat loss near to zero, with energy production over some period of time. Such envelope should support the overall solution of the building in the best way. In general, priorities will be given to renewable and recycled materials. The frame with optimal structure should be wooden-based. The composition of layers in opaque part of the envelope will be a subject of advanced mathematical simulations, especially for situation with integrated photovoltaics and with increased thermal inertia created by using of phase change materials (PCM) and thin layers of high performance concrete (HPC). Thermal insulating layers should consist of traditional and advanced materials (super-insulations) or of their optimal combination. The photovoltaic electricity should be used indirectly or directly in the building interior. The work will cover the mathematical simulations (multidimensional heat transfer under non-steady conditions etc.) in several steps, starting with design of experiments, further supporting

experiments in small scale, real experiments in full scale (climatic chamber, real exposition). Other important phenomena of building envelope will be analyzed as well, especially moisture transfer and air-tightness. Mentor: Prof. Tywoniak.

Fire resistance of timber based houses
Work will focus on experimental, numerical and analytical simulations of fire resistance of timber multi-storey buildings. Particular attention will be paid to the use of new isolation materials and its current dimensions, construction details, and electrical distribution systems, which can significantly achieved values of curtain wall panels and wood-based discarded. Outputs will focus on the use of composite wood deeper silicate materials with a focus on advanced reinforced concrete structure with the third generation of wires and their combinations. When working with the transition from the verification of individual elements to use behaviour of the structure as a whole, including the ceiling membrane behaviour in case of large deformations. The contributions will focusing gradually on the description of materials behaviour, the behaviour connectors, composite beams, and finally of a whole floor slab as and the behaviour of the entire structure weakened penetrations and openings. Mentor Prof. Wald.

Fire property of timber based panels
Work will focus on experimental, numerical and analytical simulations of fire properties of timber based buildings. The Full scale room test for surface products, according to ISO 9705:1993 will be used to describe the fire behaviour of a new products under controlled laboratory conditions. Experimental work will be focused on full-scale fire testing and numerical simulation of fire in enclosure, i.e. in building interior. Particular attention will be head towards to fire characteristics verification of products for surface working of building structures (walls, ceilings etc.), their reaction to fire, contribution to fire growth and flashover effect, rate of heat release, analyses of combustion products etc. Fire testing will focused on progressive building products and components in their development process, on the products that cannot be or are not appropriate for small-scale testing (thermoplastics, composite materials, board products with junctions or joints, thermal insulation etc.) or on the products, where there is an eminent interest to verify their behaviour during real fire scenario. Mentor Prof. Wald.

Robustness of timber based houses
Work will focus on experimental work and numerical simulations of advanced fire resistance of composite steel and concrete structures under blast loading, earthquake and fire, including their combinations. Particular attention will be paid to the deformation capacity of the elements and their connections, the use of new materials and construction details. Outputs will focus on a deeper use of composite steel silicate materials with a focus on advanced reinforced concrete structures reinforced with advanced new generation and its combination with classical reinforcement. When working with the transition from the verification of individual elements to use behaviours of the structure as a whole, including the concept of deformable solid columns and ceilings method vulnerability and the ceiling membrane behaviour when large deformations. Assumed contributions will focus to gradually on the knowledge of the behaviour of the connections, the behaviour of slab as a whole and the behaviour of the whole structure in interaction with columns and vertical reinforcement system. Mentor Prof. Wald.

General requirements

We are looking for candidates who

- hold a Ph.D. degree (or equivalent) in the research area related to the selected topic,
- have an ability to perform independent research with a strong emphasis on publications in refereed journals,
- possess excellent communication skills and written/verbal knowledge of the English language.

We offer

- the possibility to work in a newly established dynamic and ambitious research center with the state-of-the art equipment,
- a 30 month contract with a critical evaluation after the first year,
- a gross salary of 56,000 CZK per month (approximately 2,200 Euro or 2,800 USD),
- a partial coverage of the mandatory social and medical insurance by the employer (the employee has to contribute 6.5% of the gross salary to pension insurance, 4.5% to health insurance and, according to the currently valid legislation, approximately 16.5% is deduced as income tax),
- the coverage of travel expenses of up to 55,000 CZK per year,
- the coverage of operating costs of up to 40,000 CZK per year.

Application

For more information, please contact the mentor using the e-mail address specified above.

Interested candidates are invited to send their applications directly to the relevant mentor. The application must contain:

- a Curriculum Vitae (one page),
- a motivation letter (two pages), stating personal goals and research interests,
- a detailed list of publications,
- two letters of recommendation **sent by the referees directly to the mentor** (with detailed contact information: email, telephone number and address), one of them written by the previous supervisor,
- a certificate of proficiency in English (CAE, TOEFL or equivalent) or an electronic copy of the candidate's Ph.D. thesis written in English.

Both national and international applications to this advertisement are appreciated. Review of applications will begin immediately and continue until all the positions are filled. Promising candidates will be contacted by e-mail, and will be invited for an interview at the Czech Technical University in Prague (with reasonable travel costs covered by the project).

esf evropský sociální fond v ČR
EVROPSKÁ UNIE
MINISTERSTVO ŠKOLSTVÍ, MLÁDEŽE A TĚLOVÝCHOVY
OP Vzdělávání pro konkurenceschopnost
INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ