The VŠB-Technical University of Ostrava
is searching for suitable candidates for
post-doctoral research positions

The VŠB-Technical University of Ostrava is a technical and economic institution providing bachelor's, master's and doctoral levels of education, based on free and internationally oriented research. It has the right of conferring academic and scientific degrees, as well as doctoral honorary degrees.

The VŠB-Technical University of Ostrava ranks among the top technical universities in the Czech Republic. It is equipped with excellent research infrastructure and modern laboratory facilities. The scientific and teaching staff collaborate with research and academic institutions and experts on both national and international levels, number of multinational research teams evolve the science and development at the University.

Currently we offer 17 post-doctoral (postdoc) research positions on the following five themes (project modules), supported by the EU Operational Program Education for Competitiveness and the Czech state budget:

A. **IT for solving crisis situations** (IT for disaster and traffic management)

(4 postdoc positions; contact: Assoc. Professor Vondrak, vit.vondrak@vsb.cz)

B. **Numerical methods and libraries for parallel computing**

(2 postdoc positions; contact: Assoc. Professor Kozubek, tomas.kozubek@vsb.cz)

C. **Modelling in nanotechnologies**

(4 postdoc positions; contact: Professor Pistora, jaromir.pistora@vsb.cz)

D. **IT for knowledge processing**

(2 postdoc positions; contact: Professor Snasel, vaclav.snasel@vsb.cz)

E. **Smart systems in energetics**

(5 postdoc positions; contact: Professor Cermak, tomas.cermak@vsb.cz)

A basic description of each project module, the contents of the postdoc's work and specific project module requirements for the candidate (expected education, knowledge, experience and skills) are specified below in Part II.

The positions will be located in Ostrava, the third-largest city in the Czech Republic. The employer will be The VŠB-Technical University of Ostrava. Postdocs will be employed full-time as an academic worker for a fixed period of up to 2 years. The gross salary ranges between 40 – 60 thousand CZK a month (EUR 1600 – 2400). The main postdoc activities are: participation in research activities in a relevant team of experts, preparation of new joint research projects, publication activities, teaching, active

participation in workshops and conferences, foreign internships or internships in the application sphere for 3 – 6 months.

For informal enquiries about any aspect of the positions, please contact the relevant investigator mentioned in the parentheses above.

PART I: THE SELECTION PROCEDURE

The candidate shall apply to one main project module and can add one more project module as an alternative. If not selected for their main project module, the candidate will be evaluated for their alternative project module.

Interested candidates should send the following documents in the Czech or English language to petra.gresova@vsb.cz by no later than **April 30, 2013**:

1. An application containing the candidate´s contact information incl. e-mail address, chosen project module (or alternative module) and **additional specialization** if it is mentioned in the chosen project module.
2. A Curriculum Vitae including a brief description of research and educational experience
3. A copy of their Ph.D. degree or similar degree if they studied abroad
4. A certificate proving their level of knowledge of the English language
5. A bibliography containing all information relevant to determine the value of partial evaluation criterion Nos. 1 and No. 2, in the marking and structure as below:

      A.1   an article in an impact journal (stated on the Web of Science)

      A.2   an article in a reviewed magazine (stated on the Scopus)

      B.   a professional book

      D.   an article in a collection of proceedings

      P.   patents

      Z.   pilot plants, verified technology, variety, breed

      F.   utility model, industrial patterns

      G.   prototypes, functional samples

      H.   results realized by the provider

      N.   certified methodology and procedures, specialized maps with expert contents

      R.   software

      V.   research reports that contain classified information

The articles accepted into print by the publisher or the articles sent to the publication may also be mentioned.

6. Research plan (max. 3 000 letters) in which the candidate specifies his/her idea about the technical contents, focus and goals in the postdoc position and the candidate´s motivation for seeking the particular position. The research plan is essential to determine the value of partial evaluation criterion Nos. 3 and No. 4.
7. Information (max. 2 000 letters) about attended internships that lasted a minimum 1 month in a foreign academic workplace (foreign candidates may state Czech workplaces): the name and the address of the workplace, the length of the internship, specialized contents, obtained knowledge and skills and the outputs of the internship. The information is essential to determine the value of partial evaluation criterion No. 5.

The selection procedure has two phases. In the first phase, the candidates' following qualifications will be verified:

1. If the candidate successfully completed and obtained a Ph.D. degree or similar degree if they studied abroad as defined by Czech regulation 111/1998, the Higher Education Act.
2. If the candidate successfully completed and obtained a Ph.D. degree or similar degree if they studied abroad on or after March 29, 2008; the decisive point is the day that the doctoral thesis was defended.
3. Good knowledge of the Czech or English language (CAE or the equivalent).

Those candidates who do not meet the above mentioned criteria will be excluded from the selection procedure. Those candidates meeting these qualifications will be assessed by a special evaluation committee (the second phase). Selected suitable candidates will be invited for interviews taking place in Ostrava, Czech Republic (a specific date and location will be provided). Interviews will be held in Czech and/or English.

Candidate assessment criteria and the rates:

Partial evaluation criteria		Rate
No. 1	The number and quality of articles in impact journals	50%
No. 2	The number of other outputs defined in the RIV[1] methodology	25%
No. 3	The quality of the presented research plan	10%
No. 4	The relevance of the theme / scientific importance	5%
No. 5	Internships in a foreign academic workplace	5%
No. 6	Language skills	5%

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[1] For candidates, who don´t have their outputs in RIV (Register information on the results), their outputs will be evaluated according to the structure and evaluation system in RIV.

PART II: BASIC INFORMATION ABOUT THE PROJECT MODULES, POSITIONS AND REQUIREMENTS

Project module A: IT FOR SOLVING CRISIS SITUATIONS (IT for disaster and traffic management)

A.1 A basic description of the project module

The main objective is to establish strong research group with high level competency in the application development and support for disaster and traffic management. A software tool for such support is developed for several years at The VŠB-TU Ostrava and is called FLOREON+. FLOREON+ collects modelling and simulation tools for prediction of floods, traffic, environmental pollution and other crisis phenomena. The important part is also GIS data pre- and post-processing, uncertainty handling, risk assessment and models validation and calibration. Particularly, the research team will focus on very large data models, their processing and very complex physical simulations, which must be solved on powerful computational resources.

A.2 The contents of the postdoc's work

Specialization 2

The position is open for application of talented and dynamic young scientists with a proven strong background in geoinformatics and hydrology. Desired problems to be solved are: preprocessing of hydrological data, hydrological modelling including validation and verification of results.
The objective of his/her work will be to develop and implement new methods for processing of geographical and hydrometeorological data and their use for hydrological modelling and prediction of flood risk. Innovative methods for uncertainty and sensitivity analysis of collected data and hydrological models are also necessary to be studied and developed.

Specialization 3

The main topic of the research work proposed for the position consists in the development of the new or improved approaches for modelling and simulation (macro-, mezo-, micro-levels) in the area of traffic and surface transportation, as well as for data fusion within this domain. We offer very motivated team where the excellent results represented by the software of the high quality and reliability as well as publications in scientific journals and conferences are required. A strong will to cooperate with international partners is appreciated including the readiness to stay abroad for some period of time. Also the stays at companies are planned to obtain practical experts skills in the area of traffic modelling and simulation.

Specialization 4

The position is open for application of talented and dynamic young scientists with a proven strong background in mathematics, probability, modelling, optimization, system engineering and analysis, reliability and safety engineering, risk analysis. Desired problems to be solved are: traffic crisis problems under different hazardous accidents, risk evaluation and prediction in critical infrastructures, etc.

The objective of his/her work will be to develop new analytical and simulation algorithms for risk modelling of different engineering systems and situations coming from cooperating applied field. Innovative methods for uncertainty analysis are also necessary to be studied and developed. Additional objective will be to create decision support technology serving for different risky and crisis situations and disasters.

Specialization 5

The position is open for application of talented and dynamic young scientists with a proven strong background in informatics and high performance computing. Desired problems to be solved are: enabling of very large environmental computational fluid dynamics modelling on HPC resources including their pre- and post-processing.

The objective of his/her work will be to develop and implement a new framework for remote execution of hydrological and air-pollution models on HPC resources. This work includes collecting and pre-processing of model's input data, solution of very large problems on computing clusters and post-processing of results for visualization and model's evaluation.

A.3   Specific project module requirements for the candidate (expected education, knowledge, experience and skills)

Specialization 2

The candidate should have an outstanding curriculum of studies and a record of high quality research. Expertise in earth remote sensing and flood modeling on high performance computers is necessary. Programming skills in HPC are an advantage. Preliminary experience in practical modeling of flood lakes is expected. Finally, the candidate must have a positive attitude for working in team, under the supervision of Mentor and collaboration with international partners. Fluency in English is required. Special requirement: at least one journal article per year in a recognized journal with impact factor.

Specialization 3

Ph.D. in the area of computers science with experience in the fields of surface transportation is necessary. The knowledge and ability to use software for traffic modelling like AIMSUN, VISSIM/VISSUM is an advantage. Further skills expected for the position comprise the knowledge of some object programming language, methods for parallel computations, GIS approaches and solutions, usage of UNIX-based high-end computers (user's level), and fluency in English. The candidate must clearly show her/his capability of doing high-level research (journal publications or other applied research outcomes).

Specialization 4

The candidate should have an outstanding curriculum of studies and a record of high quality research. Open mind and curiosity for innovative solutions to practical problems of system engineering are also necessary attributes. Expertise in energy and traffic systems and technologies would also be useful preferably in context with safe critical infrastructures (e.g. power grids, nuclear, oil and gas, road transport). Finally, the candidate must have a positive attitude for working in team, under the supervision of Mentor. Preliminary experience in cooperation with industry would be appreciated.

Programming skills are expected preferably oriented on supercomputing. Fluency in English is required. Special requirement: at least one journal article per year in a recognized journal with impact factor.

Specialization 5

The candidate should have an outstanding curriculum of studies and a record of high quality research (journal paper, result of applied research). Expertise in high performance computing and mathematical modelling is necessary as well as high-level programming skills. Preliminary experience in practical modelling in hydrology or air-pollution is an advantage. Finally, the candidate must have a positive attitude for working in team, under the supervision of Mentor and collaboration with international partners. Fluency in English is required.

PROJECT MODULE B: NUMERICAL METHODS AND LIBRARIES FOR PARALLEL COMPUTING

B.1   A basic description of the project module

The objective of the research activity is the development of scalable numerical methods for the solution of partial differential equations. The research involves discretization, error estimates, identification of material constants and optimisation, including material, geometrical, and contact nonlinearities; studying of iterative solvers with respect to efficiency, robustness and parallelisation. Further using selected commercial and open source software packages to solve extremely difficult problems of applied mechanics arising from bilateral projects. Planned activities also involve research into the field of scalable algorithms based on FETI domain decomposition methods, their adaptation to other engineering problems such as CFD, the analysis of the complexity of the developed algorithms and optimisation of parallel processes, and research into molecular dynamics.

B.2   The contents of the postdoc's work

Specialization 1

The main focus of the research work proposed for the position is development, implementation, and testing of parallel scalable algorithms on heterogeneous architectures, and application of communication avoiding and hiding techniques. During the position one or two stays are planned in collaborating industrial companies or at collaborating institutions abroad. Three papers in international journals with impact-factor are expected. Further outputs of the position will be presentations of results at scientific conferences, publications in proceedings, and specialized software packages in Matlab, C++, and PETSc.

Specialization 2

The successful candidate will be concerned with development, analysis and implementation of parallel computational methods for homogenization of the Helmholtz and Maxwell equations in 3 dimensions. The methods under consideration will mostly rely on boundary element discretization and domain decomposition techniques. They

will be validated by solution to engineering problems typically arising in the related project module Modelling in nanotechnologies as well as to problems arising in recent collaboration with industry. For each year, one or two one- to two-month's stays are planned at collaborating institutions abroad and, as mandatory outputs of the research work, one paper in an international journal with impact-factor is expected.

B.3 Specific project module requirements for the candidate (expected education, knowledge, experience and skills)

Specialization 1
A successfully finished Ph.D. study in the computer science or electrical engineering is a mandatory requirement together with advanced experience in the fields of signal and image processing and supercomputing. Further skills expected for the position comprise the knowledge of Matlab, C, C++, C#, MPI, OpenMP, CUDA, and fluency in English. The candidate must clearly show her/ his capability of doing high-level research (at least two impacted publications, preferably in Q1 or Q2 of their main Journal Citation Reports group and at least one as the first author).

Specialization 2
A successfully finished Ph.D. study in mathematics or computational physics or engineering with a focus on numerical solution to boundary value problems for partial differential equations is required, experience with homogenization methods, boundary integral equations, domain decomposition, Maxwell equations, C++ programming language or parallel programming being an advantage. The candidate must clearly show her/his capability of doing high-level research (at least one impacted journal publication as the first author).

PROJECT MODULE C: MODELLING IN NANOTECHNOLOGIES

C.1 A basic description of the project module

The cardinal idea of this module is fundamental and applied research focused on 1D, 2D, and 3D nanostructures and nanosystems: the development of new magnetophotonic nanostructures (determination of new materials and principles for sensors related to all frequences from DC to UHF, unidirectional magnetooptics for IT, magnetic and MO recording), specification of new approaches in nondestructive testing, new medicine forms modelling, advanced nanocomposite design with defined nanocomponents (metalic and metal-oxide nanoparticles, polymeric nanotubes, organic supermolecular nanostructures, anorganic nanotubes and carbon nanomaterials).

C.2 The contents of the postdoc's work

The postdoc comes in science laboratories oriented on mentioned research and development. The research outputs have to be published in IF journals, prospectively by patents. In the frame of postdoc stays at VŠB–Technical University of Ostrava are prepared complementary research stages in USA and Canada.

C.3 Specific project module requirements for the candidate (expected education, knowledge, experience and skills)

The fundamental condition is completed Ph.D. study in Physics, Chemistry, Material Engineering, Applied Mathematics, Electronics and related fields. The research is realized on theoretical and experimental levels and postdocs are assumed come in both research branches.

PROJECT MODULE D: IT FOR KNOWLEDGE PROCESSING

D.1 A basic description of the project module

Implementation of massively parallel bio-inspired (Specialization 1) or softcomputing (Specialization 2) algorithms using GPU. Furthermore, using the ReduceMap methods will be elaborated for future use of these algorithms on GPU clusters. These algorithms will be applied in the areas of SmartGrid, BCI, protein analysis and sensorless motor control.

D.2 The contents of the postdoc's work

Main focus of the work is the knowledge transfer with massively parallel computing using the GPU cluster into practice:
- development and implementation of bio-inspired algorithms or softcomputing algorithms usable in the GPU cluster environment on a supercomputer,
- experiments with these algorithms over real data during the internship in the application sphere,
- teaching courses with possible application of the GPU.

D.3 Specific project module requirements for the candidate (expected education, knowledge, experience and skills)

The candidates should be graduated in some of these or similar disciplines: computer science, mathematics, economics, etc. Highly motivated candidates with programming skills or theoretical skills in mathematics and logic are preferred. The candidates should be able to cooperate in a teamwork setting as well as to pass their skills to other students and researchers. Therefore, English knowledge and publication skills are presupposed. The candidates should be also able to present their results in an international forum, take an active part in international workshops and conferences. Research results will be published in high-level international journals.

PROJECT MODULE E: SMART SYSTEMS IN ENERGETICS

E.1 A basic description of the project module

Three research activities are joined into one undivided whole – it is the treatment and processing of input sources, i.e. alternative fuels, and development of corresponding machine equipment and activities focused on fuel transformation (especially

gasification, pyrolysis and even combined combustion and fermentation) into products of better product usability, as H2.

The project concerns as well a research group concentrating on R&D of new cogeneration units, problems of energy accumulation and problems of electric generators - their operations control and connection to an off-grid island system. The section of the fuel transportation and processing and its transformation into gases which can be used in turbines with electric generators is supported by a group focusing on research and development of nano-composite materials for purifying all output products of the transformation process.

The project also focuses on the monitoring of the usability of produced electric power in the electric network in the Czech Republic and it do not ignore the use of accumulated electric power in the period of its surplus – hybrid technology.

It concerns the research and development of technologies for fuel transformation, especially of waste products and alternative fuels, into heat energy and electric power and their further effective use.

The objective is the research and development of units (technology and energy units) for waste treatment and alternative fuels and intensification of their transformation into heat energy and electric power with parallel ensuring of purity of combustion products, monitoring of quality and quantity of final products and monitoring of possibility of energy accumulation and parallel or serial cooperation of various resources.

E.2   The contents of the postdoc's work

Postdoc will be full-time researcher in electric power system as integral part of renewable energy systems, which combine traditional and new technology of control the flow of electric power with the adaptability to the power use and storage possibility. Research will be focused on:

- integrating variable energy resources in control center with variable consumption and storage possibilities
- developing of new synchron generator of electric energy with permanent magnets integrated with new type of turbines
- developing of microcogeneration unit with thermal storage
- increasing of efficiency the different types of renewable energy systems
- developing of interaction between short term and long term energy storage system (battery, supercapacitor, fuel cell storage, electromobility)
- research and developing of microgrids
- research and developing of new smart and interactive Inverters (DC to AC Converters) for renewable energy systems

Research will be in collaboration with our industrial partners, part of these research activities will be located at our industrial partners.

International cooperation with TU Dresden, RWTH Aachen (Germany), TU Wien (Austria), SIU Carbondale (USA) and others open possibilities of exchange stay.

New creative teams in priorities of scientific research
CZ.1.07/2.3.00/30.0055

E.3 Specific project module requirements for the candidate (expected education, knowledge, experience and skills)

Candidates must be graduated in electrical-, mechatronics-, processing- or chemical-engineering (dipl. Ing., Ph.D.), professional experience oriented to power electronics, energy generators, renewable energy systems, electromechanical systems, chemical processes is preferable.

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