Post-doc Positions in Applied Industrial Mathematical Modelling and Computational Mathematics

The Center for Mathematical Sciences Applied to Industry (CEPID-CeMEAI) has three post-doc positions available for starting immediately. The requirements for each of the positions are described below. The salary is R$5908,00 (USD 2500,00) per month tax free. The appointed Post-doc will also get return travel from his/her country to Brazil paid by the grant. CeMEAI is a consortium of several Universities in São Paulo State and each of the positions will be fulfilled in a different location, as stated in the descriptions below. The positions are initially for one year, renewable for a second year pending on suitable performance.

**1) Post-Doctoral Research Project**

Departamento de Matemática Aplicada - Universidade Estadual Paulista - UNESP - São José do Rio Preto-Brazil

Location: São José do Rio Preto – São Paulo State- Brazil

Title: Optimization models and solution methods to support decisions for the production planning of furniture plants

Supervisor: Socorro Rangel

**Job Description/Requirements:** This project aims at developing and applying optimization models and solution methods to support decisions for the production planning of furniture plants. A case study will be conducted in a plant located in the Votuporanga Regional Center in the state of São Paulo-Brasil with the objective to improve the plant productivity. Mixed Integer mathematical Models together with decomposition solution methods are to be developed and integrated in a Decision Support System already in test by the Modeling and Optimization group at UNESP-São José do Rio Preto, Brazil. Considering that the optimization problems involved in production planning of furniture plants are of combinatorial nature, the need to develop solution wise efficient mathematical models is a challenge considered to be answered with this project development. The successful candidate is expected to start in October/November 2013.

Interested candidates should e-mail a CV and two letters of recommendation from university professors as soon as possible to:

Socorro Rangel (socorro@ibilce.unesp.br) or Silvio Araujo (saraujo@ibilce.unesp.br).

Contract Condition: Grant from FAPESP under the Research, Innovation and Dissemination Centers (RIDC-CeMEAI) (http://www.fapesp.br/en/17,http://www.cemeai.icmc.usp.br/ )

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**2) Post-Doctoral Research Project**
Aerodynamics Division - Instituto de Aeronáutica e Espaço - DCTA/IAE/ALA

Location: São José dos Campos – São Paulo State- Brazil

Title: Large Eddy Simulations and Aeroacoustics of Perfectly Expanded Supersonic Jets
Supervisor: João Luiz F. Azevedo

**Job Description/Requirements:** The main objective of the present research work is to study and develop a numerical methodology for the prediction of acoustic propagation and radiation due to the interaction of exhaust gases from rocket engines with the ambient air, under perfectly expanded supersonic jet conditions. In general, supersonic jet noise generation has three main

mechanisms: (1) noise due to turbulent mixture processes; (2) noise due to shock waves; and (3) well-defined tonal noise or screech noise. In the present work, since perfectly expanded jets are being considered, mechanisms (2) and (3) can be neglected. Therefore, only the first mechanism will be considered. It is commonly accepted that the mechanism of noise emission of type (1) can adequately be described by hydrodynamic instability theory, in which one can assume a slow evolution of the mixing layer.

The present work will use hybrid methods in order to handle the problem of interest. Hybrid methods compute sound generation and propagation separately. Typically, computational fluid dynamics (CFD) techniques are used to calculate the flow variables in the region where the nonlinear acoustic sources are located. Such flow variables are, then, used as initial data for sound propagation formulations which will yield the noise levels at distant observers. Clearly, the flow physical characteristics must be accurately captured by the CFD method in order to use hybrid methods. Moreover, the turbulent aerodynamic flows considered in the present work yield acoustic sources in a broad regime of frequencies and spatial scales. Therefore, large eddy simulation (LES) is the method of choice for the calculation of the flows of interest, since this formulation can capture the most energetic scales associated with noise generation. The acoustic analogy formulation of Ffowcs Williams and Hawkings (FWH) will be used for the acoustic calculations of sound radiation due to the supersonic jet flows of interest.
Candidates must hold a doctoral degree in Aerospace or Mechanical Engineering, or in a related area, with demonstrated experience in the calculation of turbulent flows and/or aeroacoustics. They should submit a comprehensive CV, which indicates their previous experience especially as it relates to the subject matter of the present proposal.

Interested candidates should e-mail a CV and two letters of recommendation from university professors as soon as possible to:

Dr. João Luiz F. Azevedo
Aerodynamics Division
Instituto de Aeronáutica e Espaço
DCTA/IAE/ALA
12228-903 – São José dos Campos – SP – Brazil
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Contract Condition: Grant from FAPESP under the Research, Innovation and Dissemination Centers (RIDC-CeMEAI) (http://www.fapesp.br/en/17,http://www.cemeai.icmc.usp.br/ )

**3) Post-Doctoral Research Project**
University of São Paulo at São Carlos – ICMC- Department of Applied Mathematics and Statistics
Location: São Carlos – São Paulo State- Brazil

Title: **Highly-resolved computational modeling of turbidity current phenomena at field scale**

Supervisor: Gustavo C. Buscaglia

**Job description/Requirements:** Turbidity currents are one of the main mechanisms for sediment transport into the deep ocean. The hydrodynamics involved in field scale turbidity currents lead to very complex, multi-phase, multi-scale physical phenomena. A comprehensive understanding of the interconnection between the processes at the macroscopic and microscopic levels is mandatory for accurate predictions. Highly-resolved computer models have proved to successfully describe the flow structure as well as its implication on sedimentation processes at moderate Reynolds numbers and planar bottom topography. Specifically, self-stratification effects due to sedimentation have been found to be responsible of

turbulence damping and massive sedimentation deposits formation (Cantero et al., Geophysical Research Letters, 2012, Nature Geosci., 2012).
The purpose of this project is to develop a computer model to solve for the hydrodynamics and sediment transport processes involved in field scale turbidity currents considering realistic bottom topography and ocean ambient conditions. The main features of the desired model are: Two-fluid treatment of the disperse phase, finite element/volume space discretization, LES turbulence modeling, erosion/deposition boundary conditions and topography evolution.

The successful applicant will participate of a collaborative effort being developed by the Brazilian team headed by Dr. Gustavo Buscaglia and an Argentinean team headed by Dr. Mariano Cantero. A doctoral degree in Applied Mathematics, Engineering or a related area is required, together with experience in Computational Fluid Dynamics by finite elements or finite volumes. Candidates with proven skills in performing independent scientific research and in programming for high performance computing environments will be preferred.

Interested candidates should e-mail a CV and two letters of recommendation from university professors as soon as possible to:

Prof. Gustavo C. Buscaglia
Instituto de Ciências Matemáticas e de Computação
Univ. de Sao Paulo
Av. Trab. Sao-Carlense, 400, CEP 13560-970, Sao Carlos, SP, Brasil
TEL: 55-16-33738176
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gustavo.buscaglia@gmail.com

Contract Condition: Grant from FAPESP under the Research, Innovation and Dissemination Centers (RIDC-CeMEAI) (http://www.fapesp.br/en/17,http://www.cemeai.icmc.usp.br/ )