

Project title: Automated damage localization systems for civil engineering structures: application to cracking in prestressed concrete

Project description: The goal of vibration based structural health monitoring (SHM) is to replace costly inspection campaigns by real-time instrumentation and automated data processing in order to estimate the current state of health and the remaining lifetime of structures. For damage detection, automated data-based methods using adequate statistical techniques have been developed recently. This project deals with the next level of SHM which is damage localization and focuses on the problem of cracking in prestressed concrete. The challenge is to design a data-based damage localization system based on output-only ambient vibrations. The main ingredients of the proposed method are: (i) the use of very large strain sensor networks, (ii) the development of automated and efficient data processing methods based on local spatial filters or several layers of spatio-temporal filters, and (iii) alarm triggering techniques based on unsupervised learning methods. The major innovation in this project is the use of advanced computational techniques for the creation of a large data set of virtual campaigns which are used for the design and optimization of the SHM system. In addition to these virtual campaigns, experimental developments are also foreseen, with a specific emphasis on the evaluation of different techniques for dynamic strain measurements.

Job environment: The project will be developed in the BATir (Building, Architecture and Town Planning) group of the Université Libre de Bruxelles (ULB). BATir is a joint laboratory between 4 research groups: Structural and Material Computational Mechanics, Civil Engineering and Geotechnics, Architecture, and Town planning. This association aims at creating a multidisciplinary research entity dedicated to every aspect of the art of building. In particular, this project will rely on the availability of large testing facilities (1700 square meters) and powerful computational resources (numerous in-house and commercial finite element softwares).

Job description : Two post-doctoral positions are open for a period running from January 1st 2011 to December 31 2012.

Eligibility : The candidates should hold a PhD in Mechanical or Civil engineering and should not have been working previously in Belgium. For the first position, experience in numerical modeling preferably in the field of non-linear mechanics or vibrations is necessary. For the second position, experience in experimental vibration testing and instrumentation is required.

Application. Interested candidates should send the following documents electronically to Prof. Arnaud Deraemaeker (aderaema@ulb.ac.be) together with an accompanying letter:

- Detailed CV containing the list of publications
- Copy of the PhD manuscript and PhD certificate
- Two letters of support