PhD Contract: Identification of service loads in structures

Technical University of Catalonia BarcelonaTech, UPC, Barcelona

Competitive PhD Contract within the Construction Engineering Group (https://futur.upc.edu/EC) under the project BIA2017-86811-C2-1-R Structural Models for the Efficient Management of Infrastructures: Smart BIM models (https://futur.upc.edu/22024308)

Requirements:

Good level of English, programming skills (Matlab) and knowledge of structures and structural dynamics

Academic level: Master level. (Civil Engineering, major Structures, preferred). Graduate students in their last year of master are also eligible (ending June-October 2019).

Incorporation: Tentatively Autumn 2019

Duration of the contract: Autumn 2019-Autumn 2023

Gross salary: Around 16400 €/year before taxes+ health insurance

Application ends 29/Oct/2018

PhD program: Construction Engineering https://doctorat.upc.edu/en/programmes/construction-engineering

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Summary of the competitive grant: https://www.boe.es/diario_boe/txt.php?id=BOE-B-2018-48362

Full text:
http://www.ciencia.gob.es/stfls/MICINN/Ayudas/PE_2017_2020/PE_Promocion_Talento_Empleabilidad/Subprograma_Estatal_Formacion_IDi/FICHEROS/Contratos_Predoctorales_Formacion_Doctores_2018/Convocatoria_predoctorales_2018_def_firmada_SEUIDI.pdf

More information:

http://www.ciencia.gob.es/portal/site/MICINN/menuitem.791459a43fdf738d70fd325001432ea0/?vgnextoid=131955e2d5e01610VgnVCM1000001d04140aRCRD&vgnextchannel=115222e988f75610VgnVCM1000001d04140aRCRD&vgnextfmt=formato2&id3=ed6c0217cb256610VgnVCM1000001d04140a____

Summary of the project

During infrastructure life cycle, both during construction and during service life, the contractor or the owner can measure different physical parameters (displacements, strains, service loads) in order to know if a certain project behaves in the manner envisaged at the design stage. However, few times the data obtained are associated with a certain probability of surpassing a limit state threshold. In most cases, the engineer decides to perform (or not) repair or maintenance tasks in the infrastructure without knowing its actual state based on the information provided by visual inspections and their own intuition and experience. This maintenance procedure causes safety and functionality problems. In addition, inefficient maintenance is associated with a higher cost for infrastructure managers due to severe repairs.

Despite their usefulness, decision support systems have not yet been developed operationally because of the complexity of bringing together advanced and complex scientific, mathematical and practical aspects

in areas as dispersed as parameter identification, monitoring, dynamics and reliability techniques. In addition, due to the high cost of the monitoring systems, only landmark or damaged structures are traditionally instrumented.

The purpose of this project is to correct this deficiency by developing a decision support system for managing life cycle of large civil infrastructures (intelligent infrastructure such as bridges, buildings or wind turbines). This will consist of an inverse analysis tool, in which the functional adequacy of the infrastructures associated with certain reliability index (adequacy of structural systems, adequacy of loads) will be identified. The parameter (e.g. bending or axial stifness) identification tool will allow quantification of the partial or total functionality of the infrastructure from its static or dynamic response in non-destructive tests by a parametric mathematical methodology (observability) from low-cost sensor monitoring, linking it with BIM models, allowing benefiting and interacting with the possibilities offered by virtual infrastructure modeling applying BIM methodology. To this end, problems associated with the interoperability of the information flows that allow the updating of the models based on the actual response must also be solved. The great advantage of this method with respect to most of the methods presented in the literature is its versatility, since it allows the updating of any physical property of the model.

The research group has already developed a method of parameter identification by observability techniques for the identification of structures from their static or dynamic response and has studied the application of BIM methodology for infrastructure management. The PhD thesis will focus on the identification of service loads of different structures.