

Postdoc position - Design and control methods for adaptive structures

Swiss Federal Institute of Technology (EPFL) | School of Architecture, Civil and Environmental Engineering (ENAC) | Applied Computing and Mechanics Laboratory (IMAC) | Station 18, CH-1015 Lausanne, Switzerland

The Applied Computing and Mechanics Laboratory (*IMAC*) invites applications for a Postdoc position in the field of design and control methods for adaptive structures.

Background Adaptive structures are equipped with sensors and actuators in order to counteract actively the effect of external actions. Structural adaptation is employed to redistribute the internal flow of forces through controlled shape changes so that the design is not governed by peak loads that occur very rarely. For this reason, adaptation enables a structure to operate closer to design limits in service. Previous work has shown that state-of-the-art adaptive design strategies [1, 2] can be employed to significantly reduce the energetic and material impact of structures, while improving structural performance, such as increasing the slenderness of tall buildings, spans of bridges and reducing the depth of roof systems [3, 4]. In addition, adaptation enables structures to improve their performance under loading through reusing experience (learning) [5, 6], performing diagnosis following damage and through adapting in the damaged state [7, 8]. For further information see www.gennarosenatore.com and *IMAC*.

Mission She/he will work on the interface between numerical simulations and experimental testing. Research focus will be on the development of algorithms for the design and control of adaptive structures. Testing will be carried out on a new experimental prototype adaptive structures in order to validate and improve a new design and control methodology recently developed at IMAC [9]. Project tasks will involve helping with: control system setup and calibration via measurements; implementation of control algorithms based on machine learning; implementation of new methods to combine structural layout optimization (size, geometry, topology) with actuation layout optimization (location, force capacity, stroke) for the synthesis of minimum energy adaptive structures.

Profile We are looking for candidates with a PhD or EngD degree in the broad area of structural engineering, mechanics and computation. A strong background in one or more of the following areas is required: structural mechanics, structural dynamics, control, structural optimisation, machine learning. Prior experience with Matlab and Labview is preferred. The candidate should be able to work independently and within a team. Strong skills in spoken and written English are essential.

We offer This is a unique opportunity to conduct research in a new direction in structural engineering and to gain experience working with a large-scale prototype adaptive structure. This research project is supported by Swiss National Science Foundation and by Arup UK via their program, *Global Research Challenge 2018 – Artificial Intelligence: designing and engineering in the built environment*. We offer excellent working conditions and a competitive compensation.

Start date As soon as possible

Work rate 100%

Duration The contract will end in September 2020

Contact Application should include: letter of interest, CV, publications (max. 3) and two reference letters. Please send your application by e-mail to: gennaro.senatore@epfl.ch.

References

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- [6] N. Veuve, A. C. Sychterz and I. F. C. Smith, "Adaptive control of a deployable tensegrity structure," *Engineering Structures*, vol. 152, pp. 14-23, 2017.
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- [9] A. Reksowardojo, G. Senatore and I. F. C. Smith, "Actuator layout optimization for adaptive structures performing large shape changes," *Lecture Notes in Computer Science*, vol. 10864, 2018.