brought to you by 🗓 CORE chnique fédérale de Lau

Active and Deployable Structures:

7777 ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

ENAC/EDCE²⁰¹⁰

Author: Committee: Landolf Rhode-Barbarigos Prof. I.F.C. Smith¹ / Prof. R. Motro² / Dr. N. Bel Hadj Ali¹

A Tensegrity Pedestrian Bridge

¹ Applied Computing and Mechanics Laboratory (IMAC) / ² Laboratoire de Mécanique et Génie Civil de Montpellier (LMGC)

Research concept

Imagine structures that could function like living systems changing their properties in response to changes in their environment...

- Active structures adapt to changes in their environment by adjusting their properties.
- Deployable structures can modify their shape from compact to an expanded operational one.
- Tensegrity systems are made of struts and cables in a stable self-equilibrium and are particularly attractive for active and deployable structures due to low energy requirements.

Research objective

Design a tensegrity pedestrian bridge that can change shape and properties using the same active control system...

STRUCTURAL DESIGN Search for an optimal form... ...and ensure deployment ...design and analyze the bridge... ACTIVE CONTROL DESIGN Develop an analysis algorithm... ...search for control commands Module length [cm] ...design the active control system... DEPLOYMENT or PERTURBATION Ω STRUCTURE Module relative rotation [°] ſ Actuators 1 Deployment simulation using dynamic Complexity of the control-solution space: advanced computing required relaxation Control system **EXPERIMENTAL VALIDATION**

From small scale and CAD models...







via similitude and modeling

...to a near full-scale bridge-model



