## Stem bending induces hydraulic pulse in vascular system : a physical remote signal?

J-F. Louf<sup>1</sup>, G. Guéna<sup>1</sup>, O. Pouliquen<sup>1</sup>, Y. Forterre<sup>1</sup>, H. Cochard<sup>2</sup>, B. Moulia<sup>2</sup>, and É. Badel<sup>2</sup>

> <sup>1</sup>IUSTI Laboratory, FRANCE <sup>2</sup>PIAF Laboratory, FRANCE

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The perception of mechanical stimuli in the environment is crucial to the survival of all living organisms, and plants make no exception. At the tree scale, the bending of a stem leads to a transient growth response, not only locally but also far away from the stimulated area, suggesting the existence of a long distance signal within the plant network. The nature and mechanism of this long distance signal is not well understood, but it has been suggested that it could result from a purely hydraulic pressure signal, in response to the mechanical bending of the hydrated wood tissue. Recently, such hydro/mechanical coupling have been directly demonstrated in wood and living trees in the PIAF/INRA Laboratory. The objective of our work is to better understand the physical mechanisms responsible for this hydro/mechanical coupling by performing experiments on physical poroelastic beams mimicking stems and branches. To this end, we have designed an original three-dimensional micro-device consisting of a transparent elastomer beam (PDMS) perforated with longitudinal micro-channels and filled with a viscous liquid. The poroelastic response of this biomimetic branch to a sudden bending has then been studied in a closed geometry. The main result of this study is that the bending of the artificial branch generates a global overpressure in the system. This overpressure increases guadratically with the bending deformation, and is controlled by the pore bulk modulus of the media. We propose a simple physical model to explain our measurements and discuss the results in the context of plants.

*E-mail address*: jean-francois.louf@univ-amu.fr