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Ibrahim Cheddadi, Michel Génard, Nadia Bertin, Christophe Godin

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COMPUTING A TISSUE

MODELING MULTICELLULAR SYSTEMS

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SPEAKERS

Christoph Godin
Jörg Galle
Stefan Hoehme
Mark Alber
Natalia Melkinova
Niels Grabe
Nadine Peyri ras

ORGANIZERS

Walter de Back
Sara Montagna
Roeland Merks



ALMA MATER STUDIORUM
UNIVERSIT  DI BOLOGNA



Universiteit Leiden

CHRISTOPHE GODIN

Plant Modeling and Computer Science
INRIA, France



Coupling mechanical and hydraulic processes in multicellular models of plant development

Ibrahim Cheddadi¹ and Christophe Godin¹

¹Virtual Plants INRIA-INRA team

Up to now, models of organ morphogenesis in plants have mainly focussed on the regulation of cell wall mechanical properties at cellular level, such as rigidity and mechanical anisotropy. However, growth is primarily powered by water fluxes and cell turgor.

In this work, we propose a new multicellular model to study the interaction between the hydraulic and mechanical processes involved in tissue development. In this model, turgor pressure appears as a flexible variable that can mediate between various growth constraints. We show that the coupling of both processes exhibits new emergent properties that can help interpret different aspects of morphogenesis in plant organs. In particular, in specific areas of the parameter space, the system can be interpreted as a new type of lateral inhibitory mechanism that could contribute to the amplification of organ shape differentiation.

