

Division of Civil Engineering University of Liverpool

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THE GRANULAR GENONE: AN ALTERNATIVE TO CONSTITUTIVE MODELING

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ABSTRACT

In this talk, we explore the concept of granular genome, the set of inherent properties of granular assemblies that determine, in conjunction with the (external) state, the material's emergent behavior. We will argue that this approach can be an effective alternative to orthodox constitutive modeling, which has been successful in describing material behavior as observed in a limited set of laboratory conditions, but whose fundamental ingredients remain obscure and ad hoc. Revolutionary advancements in x-ray computed tomography and computational science have enabled the direct simulation of granular materials departing directly from their granular genome and imposing the corresponding state. Recent results show remarkable ability of the genome approach in replicating the material behavior well beyond the capabilities of any orthodox constitutive model. One can then explore other, vaster, portions of the stress space to obtain a thorough picture of the material behavior. Also, evolving granular features such as breakage (extreme morphological changes), degree of saturation (multiple components), and bonding (sintering, ice, etc.) can be quantified, and their impact on the constitutive behavior can be assessed for the first time

SPEAKER BIO

José E. Andrade is a civil engineer and the George W. Housner Professor of Civil and Mechanical Engineering at the California Institute of Technology. Andrade is a world leader in developing computer models to simulate the physics of complex systems. He has written hundreds of papers and holds patents on the level set discrete element method (LS-DEM)—a computer modeling tool that can simulate the dynamical response of multi-body systems. Andrade has more than 20 years of experience in the high-tech space with projects ranging from energy to defense to planetary science. His work has been recognized with numerous honors and awards worldwide.



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