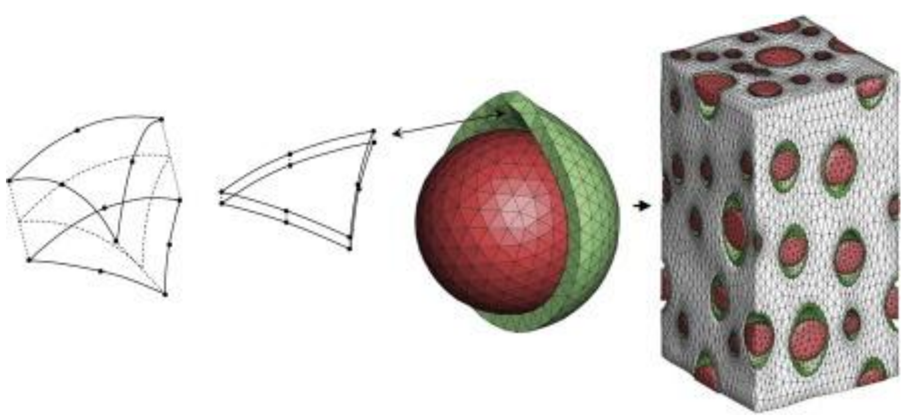
2ND KEYNOTE LECTURE : 9:45 AM – 10:25 AM JUNE 7, 2016

New frontiers in fracture and fragmentation simulations

Glaucio H. PAULINO is Professor at the Georgia Institute of Technology (USA) where he holds the "Raymond Allen Jones" Chair. He recently served as director of the "Mechanics of Materials" program (2009-2011) and the "Nano and Biomechanics" program at the NSF. His seminal contributions in computational mechanics include development of methodologies to characterize the deformation and fracture behavior of existing and emerging materials and structural systems and topology optimization for large-scale multiscale/multiphysics problems. He received the 2014 Ted Belytschko Applied Mechanics Award from ASME and is author of a new book on The Symmetric Galerkin Boundary Element Method (Springer-Verlag, 2008).

ABSTRACT

The macroscopic constitutive response of particle reinforced composites depends on several factors such as component properties, component concentrations, interphases, and interfacial debonding. Interphases are often a byproduct of surface treatments applied to the particles to control agglomeration. This interphasial region has been known to exist for many decades, but is often omitted in computational investigations of such composites. Thus we present an investigation into the influence of interphases on the large deformation response of particle reinforced composites. In addition, since particles tend to debond from the matrix at large deformations, then we investigate the influence of interfacial debonding on the macroscopic constitutive response of monodisperse and polydisperse microstructures. Cohesive elements, which follow the Park–Paulino–Roesler (PPR) traction–separation relation, are inserted between each particle and its corresponding interphase to account for frictional debonding. In addition, we illustrate the use of the PPR in several applications including pervasive fracture simulations, in which many cracks initiate, propagate, branch and coalesce simultaneously. Some of these applications lead naturally to physically based simulations (PBS). To disseminate the PPR cohesive constitutive model, a library of cohesive elements for use with a commercially available finite element analysis software package is provided.



Cohesive elements with zero initial thickness are inserted between each particle and its corresponding Interphase (Credit: Comp. Mat. Sci. **109**:209-224: 2015).