

Non-linear and Statistical Physics in Fracture: Fluctuations, instability and homogenization

Chair : Laurent Ponson (Université Pierre & Marie Curie, France), Daniel Bonamy (CEA Saclay, France) ...

Stress concentration in the vicinity of crack tips enhances the role of microscale features of solids on their macroscale failure response. This reflects on the trajectory and the dynamics of cracks in disordered solids that display surprisingly large fluctuations and on material strength that strongly vary from one sample to another. This also poses serious challenges in predicting the effective failure properties of material from their microstructural features. Last but not least, bifurcations from one mode of crack growth to another have dramatic effects on the overall failure behavior of materials.

To address these challenges, the past twenty years have seen the emergence of novel approaches, at the interface between non-linear continuum mechanics and statistical and non-linear physics. This symposium is dedicated to these new approaches and to research investigating theoretically, numerically or experimentally the passage from the small to the large scale in fracture problems. Applications of concepts emerging from this field in *e.g.* material design, failure analysis and structure monitoring are also strongly encouraged. The topics to be discussed in the symposium will include (without being limited to):

1. **Effective toughness of materials:** Homogenization techniques, emergence of effective behaviors, design of materials with exotic and improved failure properties ...
2. **Fluctuations during crack growth:** fracture surface roughness, intermittency & crackling dynamics, crack networks, acoustic emission, health monitoring...
3. **Non-linear aspects and instabilities:** mixed-mode fragmentation instabilities, instabilities in dynamic fracture, damage localization in quasi-brittle fracture, fracture in hierarchical and meta-materials...
4. **Predictability and representativeness:** Statistics of failure strength, material defect characterization, crack initiation, size effects...