



Université Lille Nord de France  
Pôle de Recherche  
et d'Enseignement Supérieur

## Ecole doctorale régionale Sciences Pour l'Ingénieur Lille Nord-de-France - 072



**Titre :** Identification of thermomechanical properties of fatigue cracking in metallic materials

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**Equipe :** COREFoU et CoNex

### **Descriptif :**

The aim of the thesis is to develop a micromechanical approach for the fatigue crack growth accounting for plastic deformation in the vicinity of the crack tip. For this purpose, the proposed work is on three complementary approaches: (i) an experimental approach, (ii) a theoretical modeling and (iii) numerical simulations. Recent experimental studies, carried out in the LaMcube Laboratory coupling monitored propagation tests, electric potential drop DCPD (Direct Current Potential Drop) and 2D (Digital Images Correlation) and 3D (Digital Volume Correlation from X-ray observations), allow the proposal of a methodology to provide the Stress Intensity Factors (SIF) under uniaxial cracking mode (dominated by  $K_I$  mode) .

One of the main objective of the thesis is the extension of the testing methodology to the case of multiaxial loads for the mixed crack modes. Our aim is the development of 3D predictive models of fracture toughness and fatigue crack growth coupling the elasticity and plasticity effects. The candidate will also examine if the plasticity is associated or not. Moreover, in the theoretical part, we propose to apply the shakedown theory in order to develop a macroscopic fatigue criterion for porous single crystals.