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# QUANTITATIVE CALORIMETRIC ANALYSIS OF THE FRETTING DAMAGE: CONSTRUCTION OF THE ELASTIC SHAKEDOWN BOUNDARY

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**ABSTRACT.** *The paper aims to illustrate the relevant use of infrared thermography and energy based approaches to study the plastic behavior and the crack initiation under plain fretting loadings. A well known 35Ni Cr Mo 16 low-alloyed steel was studied under various plain fretting partial slip conditions. The experimental results showed that the proposed 2D image processing method is able to estimate thermoelastic amplitude fields in a good agreement with the theory of linear thermoelasticity, and mean intrinsic dissipation per cycle fields reflecting localized microplastic deformation. The maximal local evolution of the intrinsic dissipation as function of the shear stress amplitude, underlined the presence of a non-dissipative regime, where the specimen mainly undergoes elastic deformation and a dissipative regime where plastic deformation take place. The transition between these two regimes was then coupled with the local elastic shakedown boundary.*

**KEYWORDS.** *Fretting; Crack nucleation; Thermography; Heat sources; Thermoelasticity; Dissipation; Plasticity; Damage.*

## NOMENCLATURE

$R$	Cylinder radius
$P$	Static normal force
$p(x)$	Hertz contact pressure distribution
$p_{max}$	Maximal Hertzian pressure
$a$	Hertzian contact half size
$a_m$	Measured contact half size
$c_m$	Measured stick zone half size
$b$	Projected crack length
$\delta$	Cyclic relative displacement
$\delta^*$	Cyclic relative displacement amplitude
$Q$	Macroscopic tangential force
$Q^*$	Macroscopic tangential force amplitude
$q(x)$	Classical shear stress distribution

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