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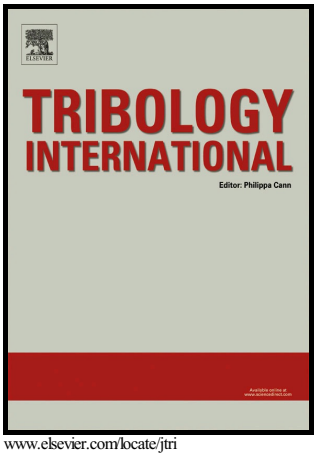

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PII: S0301-679X(17)30033-6
DOI: http://dx.doi.org/10.1016/j.triboint.2017.01.022
Reference: JTRI4562

To appear in: *Tribiology International*

Received date: 18 November 2016
Revised date: 13 January 2017
Accepted date: 18 January 2017

Cite this article as: Nadeem Ali Bhatti and Magd Abdel Wahab, Finite elemen analysis of fretting fatigue under out of phase loading conditions, *Tribiolog International,* http://dx.doi.org/10.1016/j.triboint.2017.01.022

Finite element analysis of fretting fatigue under out of phase loading conditions

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Abstract:

Fretting fatigue is a complex phenomenon involving various factors, such as slip amplitude, coefficient of friction, shear load and loading phase difference. In this study, three numerical models are used to model the effect of both in phase and out of phase loading on contact stresses and damage initiation locations. Three phase difference angles are considered, i.e. 0°, 90° and 180°, for this purpose. It is observed that phase difference affects the shear traction and tensile stress profiles at the contact interface, whereas no significant effect is observed on convergence efficiency. It is also shown that, due to increase of stick zone width, the convergence is slower during the unloading step than during the loading step. SWT parameter and Ruiz parameter are adopted as two crack initiation criteria in order to investigate their performance in case of out of phase loading. The critical locations predicted by both parameters have shown good agreement with experimental results from literature. In addition, it is observed that phase difference significantly affects the damage initiation location.

Keywords: Fretting fatigue; damage initiation location; out of phase loading; finite element analysis.

Nomenclature

$F1$	Damage parameter
$F2$	Initiation parameter
P	The normal load
σ_A	Applied axial stress
σ_R	Reaction stress
Q	Tangential load
v	Poisson's ratio
E	Modulus of elasticity
R	Radius of pad
MPC	Multi point constraint
φ	Phase difference
R_σ	Stress ratio
R_Q	Tangential load ratio