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**PROCEEDINGS**

# Identification of the Anisotropic Thermal-Mechanical Properties of Sheet Metals Using the Virtual Fields Method

**Jiawei Fu[1, 2,*], Yahui Cai[1], Bowen Zhang[1], Zengxiang Qi[1] and Lehua Qi[1]**

[1]School of Mechanical Engineering, Northwestern Polytechnical University, Xi'an, 710072, China
[2]Research & Development Institute of Northwestern Polytechnical University in Shenzhen, Shenzhen, 518063, China
[*]Corresponding Author: Jiawei Fu. Email: jiawei.fu@nwpu.edu.cn

**ABSTRACT**

The accurate characterization of the anisotropic thermal-mechanical constitutive properties of structural sheet metals at elevated temperatures and under nonuniform stress/strain states is crucial for the precise hot plastic forming and structural behavior evaluation of an engineering sheet part. Traditional thermal-mechanical testing methods rely on the assumption of states homogeneity, leading to a large number of tests required for the characterization of material anisotropy and nonlinearity at various high temperatures. In this work, a highly efficient identification method is proposed that allows the simultaneous characterization of the anisotropic yielding, strain hardening and elasto-plasticity thermal softening material properties using the minimum number of tests. This is implemented by performing a digital image correlation and infrared thermography assisted heterogeneous high temperature test and processing the full-field measurement data based on the principle of virtual work. The identification results verify that the multiple anisotropic thermal-mechanical elasto-plasticity constitutive parameters can be accurately identified from the heterogeneous test with high computation efficiency, significantly simplifying the testing process than applying traditional homogeneous tests. The current work provides an effective and convenient alternative identification strategy for the plasticity testing community.

**KEYWORDS**

Anisotropic thermal-mechanical properties; constitutive identification; heterogeneous test; virtual fields method; full-field measurements

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