Annals of the Academy of Romanian Scientists
Series on Science and Technology of Information
ISSN 2066 - 8562 Volume **4**, Number **1**/**2011**

UNCERTAINTY OF THE DISC BRAKE THERMAL STRESS MEASURED BY THERMOGRAPHY

Ștefan VOLOACĂ[1], Gheorghe FRAȚILĂ[2]

Rezumat. *Lucrarea analizează posibilitatea evaluării incertitudinii de determinare a emisivității şi a solicitărilor termice ale discurilor de frână în cazul frânării intensive. Sunt luate în considerare proprietățile materialului și soluțiile constructive ale discurilor de frână. Distribuția de temperaturi a fost evaluată de autori prin simulare în laborator în mod controlat; imaginile termice achiziționate au fost prelucrate cu un program de calcul adecvat. Pentru o frânare intensivă (în mai puțin de* 5 *secunde) s-a ținut seama de faptul că variația temperaturii discului este cuprinsă între* 20 °C *si* 200 °C.

Abstract. *The paper analyses the possibility of evaluating the uncertainty of determining the emissivity and the thermal stress for a disc brake during an intensive braking. There are taking into consideration the material properties and types of disc brake. The temperature distribution was evaluated by the authors by simulating it in the laboratory, in a controlled environment; the taken thermal images have been processed using adequate software. It has been taking into account that the temperature usually varies between* 20 °C *and* 200 °C *(in less than* 5 *seconds) for a disc brake at an intensive braking.*

Keywords: Automotive engineering, disk brake, thermography, image analysis, experimental simulation, braking, radiation, thermal emissivity

1. Introduction

The thermal stress is a result of exterior constrains during temperature variation ΔT inside the disc brake, having no possibility to expand or constrict. It can be expressed as [1]:

$$\sigma = -\frac{E}{1-\nu} \cdot \alpha \cdot \Delta T \qquad (1)$$

Where:

α – the linear thermal expansion coefficient of the disc brake material;
$\Delta T = T - T_a$, T – local disc temperature, T_a – ambient temperature,
E – Young modulus, ν – Poisson coefficient.

Deriving relation (1) with time, next relation is obtained:

$$\frac{d\sigma}{dt} = \frac{E}{1-\nu} \cdot \alpha \cdot \frac{d(\Delta T)}{dt} \qquad (2)$$

[1]University “Politehnica” of Bucharest, Automotive Engineering Department within the Faculty of Transports at the University, Bucharest, Romania, e-mail:voloacastefan@yahoo.com.
[2]University “Politehnica” of Bucharest, Automotive Engineering Department within the Faculty of Transports at the University, Bucharest, Romania, e-mail:ghe_fratila@yahoo.com.