Multidimensional magnetovisual method for mapping of pre-magnetized geometric singularities subjected to mechanical loading in the elastic range

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This paper presents the latest generation of the magnetic scanner system called Magscanner-Maglab System (MMS) which enables the fast acquisition from three axis of magnetic sensors. In recent years attempts have been made to visualize the magnetic field by magnetovision cameras. New applications of the magnetovision system are connected with measuring the magnetic field around objects subjected to technological processing (cutting, laser ablation, electro-discharge drilling, micro-layer plotting, magnetic printing, etc.), in order to check its quality. Digital visualization is used by various systems (based on discrete sensors or a matrix of sensors) for the human optical perception of real physical effects.

The proposed method of evaluating magnetic field distribution around different objects is based on modified passive sensors and on the dedicated Magscanner-Maglab software which is compatible with industrial parametric CAD, NURBS or MESH systems. The measurement technique consists in acquiring a set of points belonging to equally distant planes, similarly as in tomography and 3D visualisation in CAD under standard IGES. Magnetovisual system could also provide visualization as multidimensional manifolds for a variety of flat and cylindrical scanned objects. MMS can be synchronized with a material testing machine for static loadings or fatigue tests of the samples. Now is capable of investigating the magneto-mechanical phenomena using vector-field distribution models in experimental mechanics as well as areas of plastic deformations and cracks in industrial processes.

The identification process of inverse magnetostriction (Villari effect) for a thin plate with a circular hole (the so-called Kirsch specimen), subjected to cyclic loading on elastic range was described. The concept of identification is based on multi-dimensional magnetic fields as magnetovisual datas to describe the mechanical state of sample (the strain field) in geometric singularities (edges of the sample) of pre-magnetized ferromagnetic materials. It should also be possible to generate a range of magnetic field distribution maps depending on the proposed Villari effect model. Therefore the Kirsch problem has been implemented in the MMS software using the elementary magneto-mechanical models described the Dipole Contouring Method one can obtain a 3D magnetic field distribution [1-2].

References:

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