UPON INTERPOLATION OF CONTACT TESTS EXPERIMENTAL DATA FROM DYNAMICAL SYSTEMS

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Abstract: *For soft metallic materials subjected to contact, the loading curve of hysteresis loop presents a concavity shift. Following this notice, an interpolation function is proposed. The proposed form of interpolation function has the advantage that, expressing experimental data by logarithmic coordinates, the constants occurring in the function can be found analytically and thus an initial solution is not required, as in the case of numerical modelling. The experimental records were obtained from hardness tests performed using three punch geometries, spherical, cylindrical and conical, on spruce probes. The data were interpolated with the proposed function and with the generally used power functions. Both from plots and from squared deviations comparison it is attested that the proposed function accomplishes a much better interpolation.*

Keywords: *elastic-plastic contact, hysteresis loop, experimental data fitting*

1. Introduction

A fundamental problem in dynamical multibody systems consists in modeling the links occurring between the elements of the system. A special situation but frequently met takes place when sudden constraints are applied to the system. Subsequent to the employment of such a type of restraints, forces of considerable magnitude arise in system's kinematical joints. The impact phenomena are included in the category of rapid constraints.

Modelling collisions from dynamical systems assumes knowing the dependency between the impact force and the normal approach between the bodies subjected to impact. The first relation for this case is due to Hertz [1], who applied the results obtained by Boussinesq, [2], and showed that for the quasi-static case, the normal force from a frictionless contact between elastic bodies is directly proportional to the normal approach raised to power of 1.5.

Timoshenko, [3], admits that Hertz's relations are also valid for the case of collision and for the perfectly elastic impact between two balls finds the period of collision, the maximum approach and the maximum impact force.

The necessity of more accurate models for impact phenomena imposed considering the internal friction from materials of colliding bodies. Hunt and Crossley [4], show that in order to obtain a hysteresis loop closing in origin, it is required that the damping force is proportional to the elastic force and to the rate of deformation.

Recently, Alves, [5] makes a review of viscoelastic models developed based on Hunt and Crossley's hypothesis and identifies a number of sixteen models.

Zukas, [6], cited by Johnson, [7], demonstrates that, when two metallic bodies collide, the remnant deformations occur if the impact relative velocity is similar to the velocity of a dropping body from a height of order of millimetres and concludes that most of impact phenomena are followed by permanent deformations.

Tabor, [8], studying the elastoplastic impact between a ball and a flat surface in context of dynamical hardness estimation, accepts that, during compression phase, the impact force