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A BOUNDARY ELEMENTS FORMULATION FOR GENERAL 3D WEAR SIMULATIONS

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ABSTRACT

Wear phenomenon is presented in the mechanical surface interaction between structural and mechanical elements in contact. Wear estimation is of high interest in mechanical engineering because allow to predicts a mechanical component life, to select proper materials, and to have an optimum design for durability. In the literature, we can find a lot of works related with the wear constitutive modeling, Meng [1] and Archard [2], and with the numerical resolution and simulation.

In the numerical field, it has been developed some formulations and algorithms based on the main Continuum Mechanics numerical techniques: the Finite Element Method (FEM) and Boundary Element Method (BEM). Based on FEM, it has to be mentioned the works of Strömberg [3-4] and Prõda [5]. The first one proposes a formulation for fretting problems and the second one tackles wear problems caused by big slips when the friction is neglected. Based on BEM, Sfantos and Aliabadi [6-7] introduce a formulation for wear problems simulation caused by big slips and friction neglected, what appears in mechanized processes.

The present work introduces a new methodology for wear and fretting simulation in 3D contact problems, which can solve wear problems produced by small relative slip and by big slips where the friction is neglected. The formulation is based on the BEM for computing the influence coefficients, and on projection functions over the augmented Lagrangian for the contact restrictions fulfilment (previously used by the authors [8-9]). The bodies material loss is modeled using the Archard's linear wear law. The methodology has been validated solving some examples presented in the literature. So this formulation proof to be a interesting numerical tool for solving several kind of wear problems.

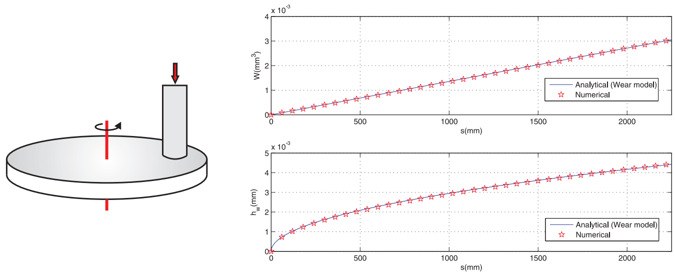

Figure 1: Pin on disc wear volume and wear depth evolution.

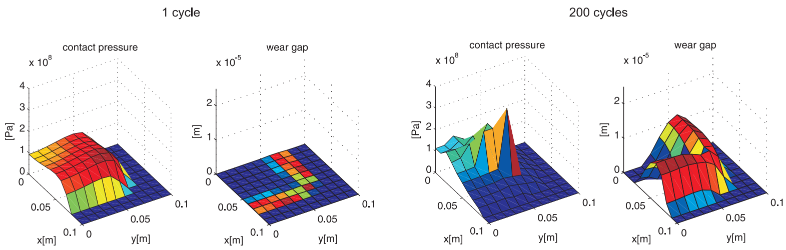

Figure 2: Contact pressure and wear depth evolution during repeated punch indentations.

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