

BOUNDARY ELEMENT METHOD FOR PERIODIC PHENOMENA, APPLICATION TO THE MODELLING OF TIRE-PAVEMENT CONTACT.

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ABSTRACT

Tire-pavement contact is defined by two key components: the roughness of the road and the viscoelastic material that makes up a tire [1].

The study of contact between a multi-scale rough surface and a viscoelastic material, can provide a better understanding of tire-pavement interaction and could be useful for tire design. Thus, the aim of this work is to propose a numerical methodology, using boundary element method, to study the relationships between a viscoelastic material and a rough surface considered to be periodic.

Indeed, a hypothesis of this work is to consider the multiscale ground as a periodic ground to model the phenomena of cyclic load that is applied on a tire by the road [2]. Historically, the boundary element method (BEM) is used for contact mechanics modelling that can provide quick results in comparison with the finite element method (FEM) especially in viscoelastic problems due to the time dependency of the material that drastically increases time simulation. The tire-pavement problem is facing such problems.

Thus, BEM often use FFT-based algorithm especially in contact mechanics to compute the relationship between pressure and normal displacement thanks to Green's function. Those algorithm helps, once again, to make some gains in time computing. Ju & Farris [3] were the first to propose such types of algorithms and Q. J. Wang & al [4] proposes new FFT-based algorithm that are more precise with less error. These new algorithms are also more specific, according to the physics that one would like to consider.

In our cases Wang, Liu and Chen propose in [4] specific FFT-based algorithms to compute periodic interactions in contact

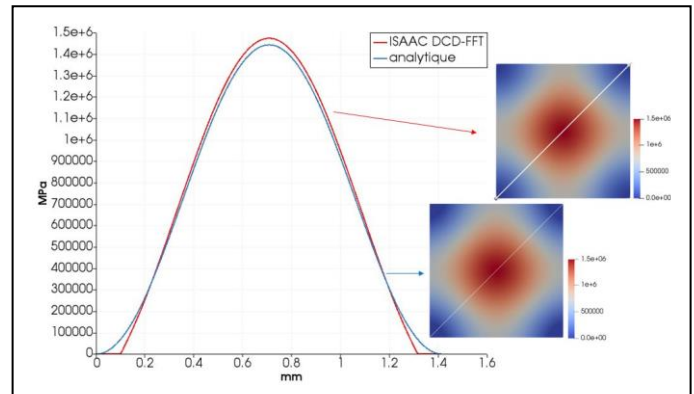


Fig.1 analytical validation on the periodic DCD-FFT algorithm

mechanics. In doing so, we finally validated and compared an algorithm from [4], the DCD-FFT algorithm, with some analytical results found in [5], see Fig.1. Those results are encouraging to model periodic phenomena but some more precise and quick algorithm exist in the literature [4], that are now investigated. This work will lead to the computation of a multilayer viscoelastic periodic sliding contact thanks to the work of E.R. Wallace [6]. Such computation could be a step forward to model a non-linear viscoelastic behavior that is the key in a tire-pavement contact, that is still complex to approach.

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