

## VIBRATORY ANALYSIS OF A CUTTING TOOL

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### ABSTRACT

The vibration problem of the cutting tools during machining has an important influence on the surface quality and the manufacturing tolerances. In this paper, we presented a modelling of the dynamic behaviour of a cutting tool, the goal is to determine, by the method without mesh of Galerkin, the frequencies and the clean modes of a tool starting from the kinetic energy and the deformation energy. A program, developed in MATLAB, makes it possible automatically to generate the calculation of the frequencies and the clean modes, under various boundary conditions.

**Keywords:** *Vibration, Modelling, Cutting tool, Method without mesh*

### 1. INTRODUCTION

The phenomenon of the vibration of the cutting tools is a major problem which appears during the process of cut of metals. This problem has an importunate influence on the qualitative level such as manufacture tolerances, surface quality.

Several studies were presented; the work of [1], illustrates an approach of the study of the dynamic stability of the system part-tool in the course of machining. In work of [2] [3], the authors present a vibratory modelling of the cutting tool in turning, they showed that the vibratory behaviour of the tool depends primarily on the angle of attack, angle strip, advance, depth of cut and the cutting speed. For the work of [4] a study was carried out on the influence cutting speed on the vibrations of chattering of the tool with an aim of proposing an analytical study by analogy with the model of Vander pole. The work of [5] presents an experimental semi study of the vibratory behaviour of the cutting tool goods of the operation of slide-lathing, fact object of showing that it is possible to consider the roughness average of the part machined starting from displacement resulting from the nozzle of the tool and for the work of [7] a study was presented on the influence of the position of the tool on dynamic behaviour in milling of thin plate.

Many branches train the family of the methods without mesh. She is related to the method smoothed particle hydrodynamics of Lucy [8] which simulates astrophysical phenomena like star explosions by a whole of particles. But, the base joint to the various current methods is the method of the diffuse elements of Nayroles, Touzot and Villon [9] which uses a basic function and a whole of nodes having each one a certain weight to form an approximation of the field of displacement then especially the method element-free Galerkin de Belytschko, Lu and Gu [10] which recognizes in the preceding approximation the approximation within the meaning of mobile least squares (MLSA for Moving Least Squares Approximation) of Lancaster and Salkauskas [11].

In this work a theoretical study on the vibrations of the cutting tool which makes it possible to choose a good design of system starting from the frequencies and the clean modes.

### 2. MODELLING OF THE VIBRATORY BEHAVIOUR OF THE CUTTING TOOL

In general, we can consider that a structure or an element of structure will be of beam type if one of its dimensions (length) is large in front of the two others. The experiment [12] watch which we can make a known simplifying assumption under the name of assumption of *Bernoulli-Euler* who expresses himself as follows:

“Any normal plane section with average fiber before deformation remains plane and normal with this average fiber after deformation (effect of null shearing)” [13] [6].

In our case, one can modelize the cutting tool by a free beam fixed, like illustrates it the figure1.