# Introduction

The studies about metal matrix composites, from the point of view of theoretic and experimental, had been ever developed great interesting, due to their high application capacity that marks them.

The production technology and the tool machining are the most critical points for the complexity of the material. Therefore it has been taken the choice of proceeding to this two aspects, developing the present work by a research of a complete literature and reliable models for the theoretic part, and carrying out a complete experimental campaign.

In particular the work has been carried out studying two kind of composite: a titanium matrix composite, the Ti6Al4V/$SiC_f$, and aluminium matrix composite.

About the first case, regarding a composite reinforced by long unidirectional fibers, two different type of composite, different about their specific fabrication process (*Hot Isostatic Pressure* and *Roll Diffusion Bonding*), have been considered.

Studies about the kinetics diffusion of the chemical elements present on the fiber/matrix interface have been developed, and to that particular micro-analysis methodologies have been adopted to characterized the same elements and their concentration. Then mechanical tests to assess the structural stability of the composite have been also carried out.

The elastic and anelastic properties of the materials have been investigated by using a vibrating reed technique with electrostatic excitation and frequency modulation detection of flexural vibrations. By these particular tests it has been possible to put in evidence, for both type of the composite, the presence at high temperature of a relaxation peak, that has been studied about the correlated phenomena.

The second part of this work gave the opportunity to extend the studies about the aluminium matrix composite reinforced by short fiber or particle, that are characterized by an higher workability at the tool machine.

In this case the study has considered an experimental plane characterizing this latter material about a very common application in industry as drilling operation. The forces at stake and their influence on the cutting conditions have been evaluated, during different work conditions, especially about the workpiece temperature.