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Fatigue Test Bench Manufacturing by Reusing a Parallel Lathe

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Abstract. Fatigue life of machined parts strongly depends on their surface condition. The rotating bar bending fatigue testing method is widely used to obtain the fatigue behavior of metallic materials due to its simplicity. In this work, the methodology for the design, manufacturing and setup of a fatigue test bench is exposed. The main novelty lies on the reuse of several elements from an old parallel lathe, currently out of order, and their use to manufacture some parts for the test bench. In this way, a double objective is achieved: high quality elements are recycled and the machine manufacturing cost is reduced.

Keywords. Fatigue life, fatigue test bench, reusing, machining, light alloys.

1. Introduction

Surface integrity is one of the quality aspects most appreciated in aircraft machined structural parts due to its proved influence on their reliability and functionality [1]. This concept takes into account both geometric deviations of the surface and its physical-chemical properties [2]. Surface quality is strongly influenced by cutting parameters (cutting speed, feed-rate and cutting depth) [3]. Concerning the dry machining of light alloys (mainly aluminum and titanium), the cutting parameters influence on the geometrical deviations is widely studied [4]. However, there is a lack of research on the analysis of their influence on mechanical properties [5]. Among them, fatigue strength is one of the most important [6].

There are several methods which allow obtaining the fatigue behavior of metallic materials. The method of rotating bar bending fatigue testing is one of the most used, because of its simplicity [7]. This work is framed within this context.

Thereby, the methodology for the design, manufacturing and setup of a fatigue test bench is exposed in this research. The main novelty lies on the reuse of several elements from an old parallel lathe (motor, headstock spindle, belts...), among others. These elements are used to manufacture some elements for the test bench. In this way, high quality electrical and mechanical elements are reused and the machine manufacturing cost is reduced.

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2.4. Manufacturing Costs

The final budget of the machine was € 2351 (labor € 950 + material € 1451) distributed as shown in Figure 10. A commercial test bench with similar characteristics costs around € 5000. Therefore, more than 50% savings have been obtained by reusing the electric motor and the kinematic chain from a parallel lathe.

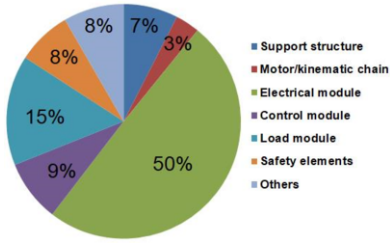

Figure 10. Manufacturing cost distribution.

3. Conclusions

In this work, a rotating bar bending fatigue testing machine was designed, manufactured and tested, according to ISO 1143 standard. Several high quality elements of a parallel lathe, now out of order, were reused to manufacture the electric motor and the kinematic chain of the test machine. Thereby, design time and manufacturing cost were reduced. Up to a 50% savings of a commercial machine cost have been achieved. Although the test bench has a general purpose, it will be used to analyze the influence of the cutting parameters on the fatigue life of dry machined parts, mainly on light alloys.

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