

Evaluation of the energy consumption in machine tools: an analytic approach

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Abstract. Reducing energy consumption will play a fundamental role in companies success. Right now, this aspect begins to be an important theme thanks to the perspective provoked by the adoption of the EU Directive 2005/32/EC, that regulates energy-using product marketing and asks to set eco-design requirements for them. The industrial sector uses more energy than any other end-user sector. In this paper an approach for the appraisal of energy consumption in machine tools is presented. The aim is to offer an evaluation tool for energy consumption in order to compare, in the future, alternative production systems and develop energy saving criteria. Numerical models, able to estimate energy consumption in a machine tool, have been coupled to a kinematic simulation software. The developed system is able to produce a report on dissipated energy in the various machine components. The proposed approach has been tested and verified on two case studies.

Keywords: energy consumption, machine tool, sustainable manufacturing, process planning.

1 Introduction

Energy is the most fundamental resource for future economic growth and prosperity and its consumption will grow over the coming decades: it is estimated that energy demand will be 45% higher in 2030 than today levels. The industrial sector uses more energy than any other end-user sector, currently consuming about one-half of the world's total delivered energy. Worldwide, industrial energy consumption is expected to grow of 40% in 2030 respect to 2006.

Recently European regulations have specifically addressed energy usage with the introduction of Directives such as Eco-Design of Energy using Products (EU