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SUSTAINABLE DESIGN OF FRICTION ASSESSMENT EQUIPMENT BASED ON AXIOMATIC DESIGN PRINCIPLES FOR REDUCED ENVIRONMENTAL IMPACT

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Abstract

In the context of increasing environmental concerns and the need for sustainable engineering solutions, the optimization of mechanical systems and experimental equipment has become essential for reducing energy consumption, minimizing material losses, and improving overall process efficiency. The determination of the magnitude of the coefficient of friction is usually carried out with the help of devices in which a sample of a certain material is pressed onto a plate or strip. By determining the value of the force at which the plate or strip can be moved, the information necessary to calculate the magnitude of the friction coefficient is obtained. Some axiomatic design principles were applied to experimentally identify a device that would allow highlighting the influence exerted by some factors on the magnitude of the friction coefficient. It is considered that axiomatic design is a sustainable way of designing products and processes, especially in the conditions of the Industry 4.0 stage. The objective pursued by promoting and applying axiomatic design principles is to contribute to the better development of equipment or process design activities. According to the first axiom of axiomatic design, the functional requirements for the design of an equipment or process must be independent. A device was gradually designed to allow the determination of the coefficient of friction, taking into account the first axiom of axiomatic design and the ways of materializing each functional requirement. Several alternatives capable of adequately responding to a certain functional requirement were analyzed in order to select a specific solution to meet each requirement. It was appreciated that by using the first axiom of the axiomatic design, it was possible to identify a constructive solution that would facilitate the evaluation of friction behavior in the case of samples manufactured by 3D printing. A variant of this device has been shown to satisfy the requirements for which it was designed and materialized.

Key words: axiomatic design, design parameter, experimental equipment, friction force, functional requirements

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