Chapter 3

Software Development for Ergonomic Compatibility Assessment of Advanced Manufacturing Technology

Arturo Realyvásquez
https://orcid.org/0000-0003-2825-2595
Instituto Tecnológico de Tijuana, Mexico

Aide Aracely Maldonado-Macías
Autonomous University of Ciudad Juárez, Mexico

Guadalupe Hernández-Escobedo
https://orcid.org/0000-0002-7516-972X
Tecnológico Nacional de México, Mexico & Instituto Tecnológico de Tijuana, Mexico

ABSTRACT

Ergonomic assessment of advanced manufacturing technology (AMT) involves several attributes. Most of these attributes can be assessed only subjectively. Several models have been developed to assess AMT from an ergonomic approach. However, these models have several deficiencies, such as 1) assessment for all alternatives in all their ergonomic attributes should be done in a single period. It lacks time pauses when decision-makings include several decisors and alternatives, 2) every person can access the information and change it, and 3) they lack the propriety of correcting mistakes once users (or decisors) have entered an unwished data. Then, the objective of this research is to develop a software for the ergonomic assessment of AMT that deletes these deficiencies. As method, axiomatic design (AD) was applied jointly with the TRIZ methodology. Software was validated with results of a previous case study. Finally, authors developed a software that removed the deficiencies of previous models.

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INTRODUCTION

Currently, ergonomic assessment covers several aspects, such as physical and psychological characteristics of employees, workstations design, physical environment conditions, organizational conditions, and technology (Carayon et al., 2006; Realyvásquez, Maldonado-Macías, García-Alcaraz, & Arana, 2018). Specifically, for the ergonomic assessment of advanced manufacturing technology (AMT), Maldonado-Macías (2009) developed a mathematical model. This model helps in the planning and selection of AMT and it includes the ergonomic attributes shown in Figure 1. Also, this model includes an Ergonomic Compatibility Evaluation Questionnaire (ECEC), which contains questions to determine the relative weighting of attributes by means of the Analytic Hierarchy Process (AHP) methodology.

However, this model has the deficiency that calculations must be done by hand, that is, there is no software that allows to calculate the weightings of the ergonomic attributes and make a decision to select AMT alternatives. Because of this, Maldonado-Macías, Guillén-Anaya, Barrón-Díaz, & García-Alcaraz (2011) created a software to calculate the weightings of ergonomic attributes of AMT. This software allows to decide for the best AMT alternative from an ergonomic perspective. Later, Realyvásquez-Vargas, Maldonado-Macías, García-Alcaraz, & Alvarado-Iniesta (2014) developed an expert system based on fuzzy rules. Nevertheless, both the software proposed by Maldonado-Macías et al. (2011) and the expert system developed by Realyvásquez-Vargas et al. (2014) have the following disadvantages:

Figure 1. Ergonomic attributes for AMT
Source: (Maldonado-Macías, 2009)
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