

April 13-14, 2023

Webinar

International Journal of Public Health and Safety

ISSN: 2736-6189

Physical occupational risks in the sequencing of a “Flexible Flow Shop” manufacturing system

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This contribution examines the following physical occupational risks, in the job orders’ sequencing of a metal-mechanic company that uses intensive labor: vibrations, ambient temperature and weight handling. These risks correspond to the critical risks in the company in question. This is how a multi-objective analysis process is structured, with the purpose to minimize the previous risks’ performance, as well as the makespan time performance. Consequently, two multi-objective methods are designed. The first of such methods is called the “critical coordinates method”, while the second one is called the “subsets’ method”. This is how the first of the methods is based on Pareto optimal fronts’ identification, whose individuals present the closest proximity to certain minimum coordinates which are relevant and feasible. In turn, the second method allows the best performance individuals of data’s each subset be crossed, ensuring that elitist solutions are obtained. The comparison of both methods, allows to verify that the first method exceeds the second one by 58%, in relation to the C-Metric indicator performance, that is, the aforementioned first method shows greater capacity of generating “non-dominated” solutions. Besides, the first method also presents better performance in determining: number of Pareto fronts (population diversity), range (greater amplitude of the data found) and coefficient of variation (greater detection of data’s variability). Based on what has been described, production sequencing schemes are proposed that aim to reduce worker’s exposure to: strong vibrations from determinated machines, maximum temperatures that occur at certain times and, additionally, the high weight handled in different operations.

Conclusion & Significance: the measures taken implementing the first method (critical coordinates) will reduce the occurrence of occupational diseases (musculoskeletal diseases, varicose veins, work stress) or the occurrence of work accidents resulting from physical fatigue.

Recent Publications (minimum 5)

Coca G and Sierra J. Occupational risks and economic variables in the manufacturing sequencing of “non-standardized goods”. *Journal Production + Clean* 2023. In Press.

Coca G. Occupational noise in the production plant scheduling. *Proceedings XXII International Congress on Occupational Risk Prevention - ORP Conference 2022*, 179-194.

Coca G, Castrillón O, Ruiz S, Mateo J and Jiménez L. Sustainable evaluation of environmental and Occupational risks scheduling flexible job shop manufacturing systems. *Journal of Cleaner Production* 2019, 209, 146-168.

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Biography

Germán Coca is professor in Universidad EIA (Colombia). He is PhD in engineering, Msc in engineering and Industrial Engineer from Universidad Nacional de Colombia. He is consultant in quality, productivity and sustainability. He worked for several manufacturing and financial companies.

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Received: : January 04, 2023 | Accepted: February 01, 2023 | Published: August 28, 2023