

Improving the Fabrication and Welding Workshop at Kuwait Oil Company for Better Worker Performance by Using Digital Human Modeling and Simulation

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Abstract

This study investigates the risk factors associated with the Musculoskeletal Disorders (MSDs) of the fabricators and welders working in the Kuwait Oil Company (KOC). To identify the level of discomfort of the fabricators and welders, we used the “Standardized Nordic Questionnaire”. Standardized Nordic Questionnaire is used for the analysis of the MSDs. By analyzing the results of the survey, problem areas in workers body are identified. Nowadays, work processes analysis by using computer software are widely used. we attempted to assess welders’ posture and its biomechanical analysis by using JACK Digital Human Modeling Software and Simulation. Moreover, this study focuses on three working postures that occur during welding processes which are welding in standing position, sitting position and kneeling position. After determining the target postures, digital human models were simulated in the JACK software to improve workers health to reduce MSD pains. There are several assessment tools that support discovering MSD related risk factors such as Lower Back Analysis, Rabid Upper Limb assessment (RULA), Static Strength Prediction (SSP), Fatigue analysis and Ovako Working posture Assessment System (OWAS). In this study, RULA, OWAS, SSP, Lower back analysis, and Fatigue analysis were performed on the human digital models. The analytical results were directly extracted from the JACK software. The results of these postures evaluated, and it is found that immediate corrective actions are required for some postures. In addition, biomechanical analysis of forces in all those postures revealed forces higher than the recommended limit by the National Institute for Occupational Safety and Health (NIOSH). JACK software provides a better assessment of workers’ conditions in workplaces. Analysis using assessment tools is a significant measure in evaluation and redesign of workstations. Some proposed solutions will be demonstrated so the fabricators and welders’ productivity and safety level will be increased.

Keywords

Biomechanical Analysis, Digital Human Modeling, Ergonomics, JACK software, MSDs, Posture Assessment, Welding Postures.

Biographies

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Kareem Abbady works as Lab Engineer at American University of the Middle East-AUM and holds a degree in Bachelor of Science in Mechanical Engineering from Alexandria University. He worked as a mechanical engineer in maintenance and operations for some companies. He has a certification from National Examination Board in Occupational Safety and Health (NEBOSH) international general certificate and Occupational, Safety and Health Administration (OSHA). He has certifications in 3D modeling from Autodesk (AutoCAD software) and SolidWorks Corp.

Suat Kasap has degrees in electrical-electronics engineering and industrial engineering. He received his Ph.D. in Industrial Engineering from the University of Oklahoma. His research interests are in human factors and ergonomics, occupational safety and health, work and process analysis, technology and innovation management, multi-criteria decision making, financial engineering, data mining, and modeling, analysis, and optimization of complex engineering problems. He worked in different Industrial Engineering Departments of the American University of Middle East, University of Turkish Aeronautics Association, Hacettepe University, and Çankaya University as an assistant professor. He has taught courses on Work Analysis and Design, Ergonomic Work Analysis, Cognitive Ergonomics Work Analysis, Safety Engineering, Technology and Innovation Management, Management of Information Systems, Introduction to Optimization and Modeling, Deterministic Models of Operation Research, Project Management, Multi-criteria Decision Making.