

Simulation of laser alloying in the form of a three-dimensional educational game

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Abstract

Statement of the Problem: The purpose of the work was to create an educational game that would familiarize the user with the methodology and equipment used in the laser alloying process. The aim of the game is to prepare the material, select appropriate parameters for the laser alloying process, and carry out the process itself on a virtual simulator. This simulation is part of the larger project of the virtual materials engineering laboratory. Therefore, the material obtained in the game can later be used for metallographic tests, which were described in the previous paper. The game was developed using the Unity environment, where all three-dimensional machine models, as well as the necessary virtual environment and gameplay scenario, were created. Thanks to the use of virtual reality, students can now learn how to use laser alloying and preparation devices without being physically present in the laboratory. This method is both attractive and safe, as there is no risk of damaging materials or equipment, and there is no danger to the user's health.

The game is currently available at the Department of Engineering Materials and Biomaterials at the Faculty of Mechanical Engineering of the Silesian University of Technology. The use of a 3D game in this study offers an interesting alternative to traditional teaching aids, making it beneficial for not only students but also teachers and others who are interested in learning more about the functioning and methods of operation of laboratory equipment.

Conclusion and significance: The virtual materials science laboratory, implemented at the Department of Engineering Materials and Biomaterials, fulfills all the necessary requirements for education in the field of materials science in a solely virtual environment. With the aid of advanced computer tools for three-dimensional modeling, it is possible to replicate the appearance of all equipment, including laboratory devices. This allows for presentations and demonstrations to take place without the need for actual physical counterparts, making it possible to conduct training using just one computer and a projector. This is particularly beneficial when access to a physical laboratory is limited or unavailable. Computers, equipped with suitable educational software and supported by IT, are among the most effective teaching aids, providing ample opportunities to enhance student knowledge, skills, and abilities.

Image

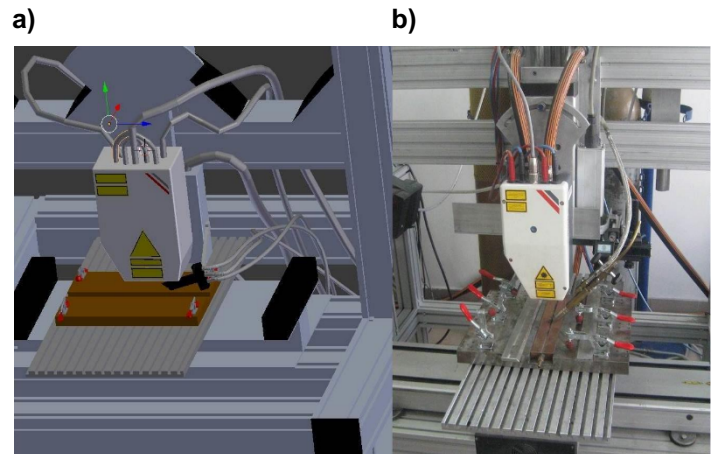


Figure 1. Comparison of the simulated 3D laser model with the laser located at the Faculty of Mechanical Engineering, a) simulation, b) real machine

Recent Publications

1. Honysz R (2022) Simulation of the preparation laboratory for light microscopy in the form of a 3D educational game, *J. Achiev. Mater. Manuf. Eng.* 113:78-85, DOI: 10.5604/01.3001.0016.1433
2. Honysz R, Dobrzański L.A (2017) Virtual laboratory methodology in scientific researches and education, *J. Achiev. Mater. Manuf. Eng.* 84/2:76-84. DOI: 10.5604/01.3001.0010.7784
3. L.A. Dobrzański 2002 Fundamentals of materials science and metal science, WNT, Warsaw (in Polish).
4. Ion J.C 2003 Laser processing of engineering materials: principles, procedure and industrial application, Butterworth-Heinemann, Oxford
5. A. Klimpel 2012 Laser technologies. Welding, surfacing, alloying, heat treatment and cutting, Laser technologies. Welding, surfacing, alloying, heat treatment and cutting, Silesian University of Technology Publishing House, Gliwice (in Polish).
6. Dobrzański L.A, Honysz R (2012) Informative technologies in the material products designing, *Arch. Mater. Sci. Eng.* 55/1:37-44
7. Gonzalez C (2012) Student Usability in Educational Software and Games: Improving Experiences. Hershey
8. <https://unity.com/> - Unity Real-Time Development Platform | 3D, 2D, VR, AR Engine (accessed 25.03.2024)

Photograph



Biography

Dr. Eng. Rafał Honysz works as an assistant professor in the Department of Engineering Materials and Biomaterials of the Faculty of Mechanical Engineering of the Silesian University of Technology in Gliwice, Poland. He is the author or co-author of 91 articles presented at national and international scientific conferences. His research interests include computer aided materials engineering, modeling, simulation, visualization, 3D techniques, artificial intelligence and virtual reality.

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