

## CONTRIBUTIONS TO DEVELOPMENT OF OPTICAL DESIGN IN MECHATRONIC APPLICATIONS

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### Abstract

The first chapter, Basic optical design. Glass choice, offers a solution to the problem of choosing the suitable sorts of glass by means of stating mathematical criteria implemented in software application. The practical solutions, including aspheric surface use, provided by the application lead to high image quality for large apertures.

The second chapter refers to Optical engineering applied in laser machining. The first paragraph develops Optics optimization in laser spot radius minimization. The research provided original solutions for the expander and focusing objective (both diffraction limited). The second paragraph is dedicated to Experimental optimization of process parameters in laser cutting of polycarbonate gears. Fractional factorial experiments plans stated by Taguchi method and a specialized software proved to be quick, economic (only 40 samples needed for optimizing six parameters in two levels and one interaction) and very efficient.

The third chapter develops some aspects regarding the Document digitization. Two paragraphs are dedicated to Digitization Equipment and Techniques in Retrieval of Mechanism and Machine Science Resources and Interactive animation production by means of advanced image processing.

Design and assembling of the scanning equipment as well as the capturing, stocking and managing raw image files software were developed as original contributions. Beside documents, the library also displays physical demonstration models and mechanism descriptions. The physical working models of the mechanisms are digitally recorded as a sequence of images. With further handling steps, these image sequences are composed to interactive animations, available on DMG-Lib internet portal or downloaded as video files for local use.

The fourth chapter develops several applications, which implement Optical engineering in medical investigation. The first paragraph describes the Modeling of human spinal column and evaluation of



spinal deformities. A large number of numerical parameters were suggested for the description of the column's shape. A special software – INBIRE – was developed to work with the imaging system InSpeck.

The second paragraph covers the subject Experimental method for evaluation of spinal column deformation, based on data acquired with a system of accelerometers and advanced image processing. The goal of the study is to develop a method to record the Cobb angles variation, which should serve to the evaluation of the efficiency of the therapy exercises.

The full thesis at:

[http://www.upt.ro/img/files/2018-2019/doctorat/abilitare/Gruescu\\_Corina/Corina\\_Gruescu\\_Rezumato\\_abilitare\\_en.pdf](http://www.upt.ro/img/files/2018-2019/doctorat/abilitare/Gruescu_Corina/Corina_Gruescu_Rezumato_abilitare_en.pdf)

### Habilitation Commission

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