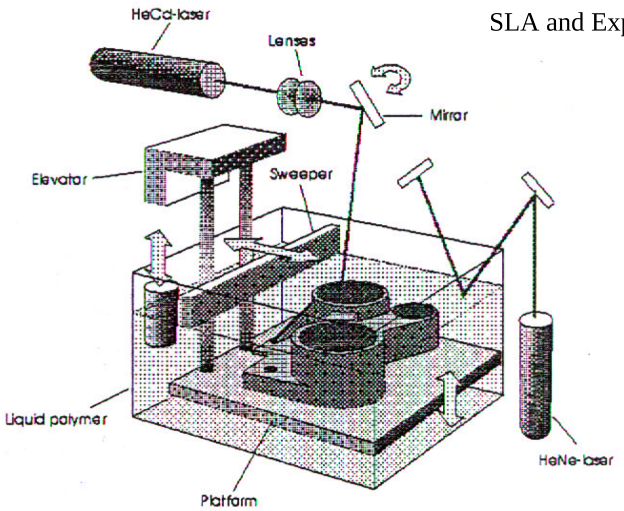
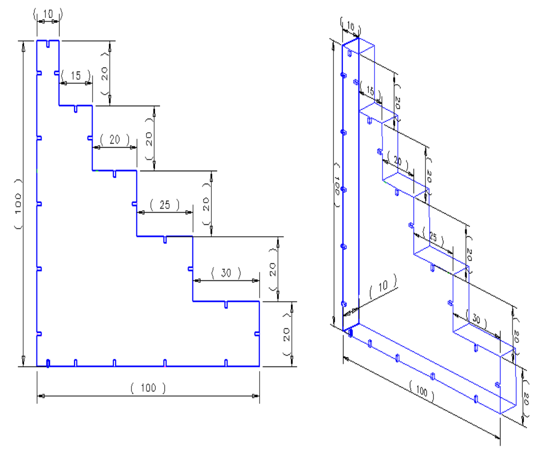
CLEMSON UNIVERSITY

CREDO LABORATORY PROJECTS

Project Title: OPTIMAL PARAMETER SETTINGS TO OVERCOME LINEAR SHRINKAGE OF STEREOLITHOGRAPHY PARTS

SLA and Experimental Test Part (mm)





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Project status: Completed – Defended Thesis
Project Duration: Jan 1997 – May 1999
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Project Abstract:

An integrated approach, which utilizes statistical experimentation methods such as ***Design Of Experiments*** (DOE) and ***Response Surface Methodology*** (RSM); quality engineering methods such as Fishbone Diagram, and the techniques of Robust Design and Optimization, is proposed to determine the optimal parameter settings to overcome linear shrinkage of stereolithography parts. The most significant building parameters that affect stereolithography part geometrical accuracy are identified using the Fishbone Diagram and the DOE. The variations of two environmental parameters, namely temperature and atmospheric humidity, are also considered as two control factors. The effects of these two environmental parameters are studied during the building phase and the robust design concept is applied to reduce the impact of their variations on part accuracy. The response surface models are used to approximate a functional formulation to represent the relationship between part geometrical accuracy and the various process parameters studied here, namely, layer thickness, hatch space, hatch overcure, X-Y shrinkage factors and postcure time.

An overall setting of post-processing conditions such as postcure time, storage temperature and atmospheric humidity, which yield the best geometrical stability is also identified via robust optimization. Through systematic experimentation, this work also intends to verify whether or not the part shrinkage due to the random noise factors is proportional to the mean process shrinkage. Parts with different geometry are built to verify that the proposed parameter settings do produce the best accuracy. Furthermore, these tests are intended to show that the accuracy does not depend on part geometry but rather on the process parameters.

This work was conducted under the supervision of Dr. Wei Chen who recently joined the University of Illinois at Chicago.

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