# *PolyStretch* Biaxial Polymer Straining Device

## Overview

The *PolyStretch* is an apparatus I designed to biaxially and uniaxially stretch polymer films in precise 2μm increments while viewing the film under an optical microscope. To accomplish this, it uses a precision stepper motor to drive a gearset that moves four polymer clips an equal amount to induce true biaxial stress.

The *PolyStretch* consists of two main components: the mechanical section, which contains the sample and stepper motor, and the controller, which allows the user to drive the stepper motor. These two components are functionally separate and connected only by a few wires. I conceived and designed the mechanics from scratch for this project using computer-aided design (CAD) software– no similar device previously existed. The controller uses a custom command line program that I created to drive the stepper motor via an Arduino microcontroller.

I worked on the *PolyStretch* project the summer after tenth grade as part of an internship with Professor Juan J. de Pablo at the University of Chicago's Institute for Molecular Engineering. I worked with two other interns, although I engineered the entire controller setup and most of the mechanics. The machine was subsequently used to study strain effects on liquid crystals dispersed in polymer films. It led to a presentation, of which I am a co-author, entitled "Strain-Induced Topological Defects and Configurational Transitions in Liquid Crystals" at the American Institute of Chemical Engineers' annual meeting.

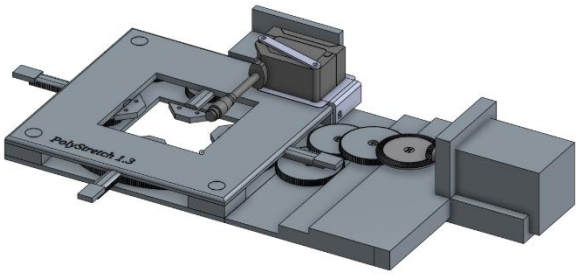




*Figure 1: Isometric view of PolyStretch CAD design, showing optional laser attachment for ultra-precise strain measurements.*



*Figure 2: Isometric view of PolyStretch CAD design with baseplate hidden, showing alignment of the gears, rods, and axles I designed for this project.*

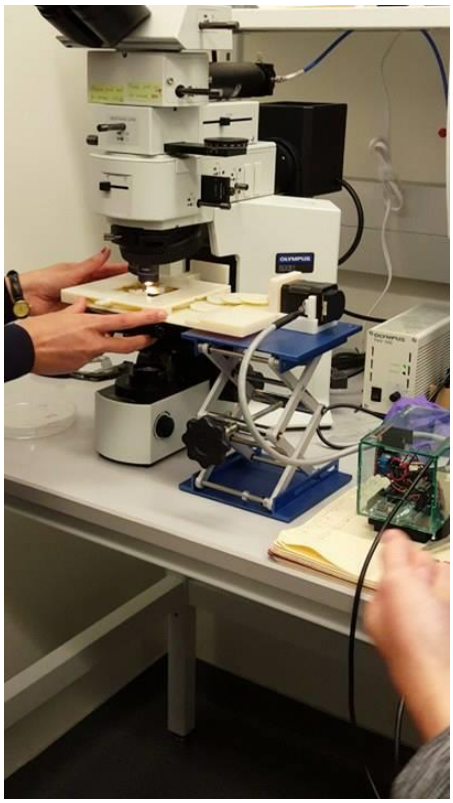

*Figure 3: Photograph of 3D-printed PolyStretch in action, stretching liquid crystals under a microscope in Prof. de Pablo's laboratory*

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