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Ultrafast Optical Oscilloscope

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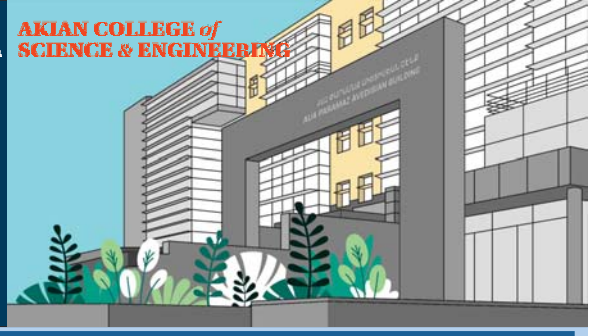
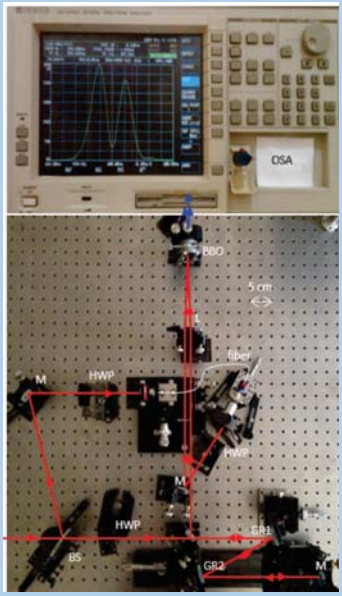
Software: Pro/ENGINEER Year:2012



Introduction

The project Ultrafast Optical Oscilloscope is aimed at creating a 3D CAD model of a device that can accurately measure femtosecond laser pulses. A femtosecond laser produces extremely short light pulses (bursts of energy) that are events in the femtosecond time scale (1 femtosecond = 10^{-15} seconds, or one-billionth of one-millionth of a second), making it challenging to characterize these pulses using standard electronic devices that are limited at nanosecond timescale (1 nanosecond = 10^{-9} seconds, or one-billionth of a second). The CAD model of the optical oscilloscope helps optimize the process of the OEM part selection required for the assembly of the device and its manufacturing. The bill of materials includes optical (mirrors, lenses, nonlinear crystals) and optomechanical components (posts, post holders, translation stages, optic mounts) that need to be assembled and positioned with a nanometer accuracy on an optical breadboard. The project helps to shrink an entire lab space to a box that is 300 mm long, 300 mm wide, and 200 mm high.



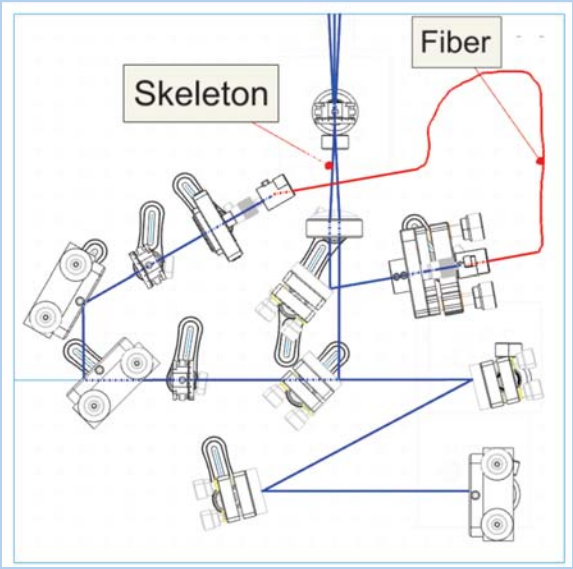


Photo on the left: Experimental physical setup showing how the device should work. The goal of the project was to find the optimal layout of the setup.

Picture on the right: In this project, Top-Down design approach was used. The modeling process started with the skeleton design (blue lines). The skeleton, in our case, provides the needed relations between the fiber length (red curve) and other physical parameters, as well as specifies the location of the components. The superimposed picture of the assembly components shows how the skeleton is used to define their location.

The Result

The picture on the left shows the computer-aided assembly of the found optimal setup of the oscilloscope. Our partners used it to implement the real setup of the oscilloscope (picture on the right).