

LASAG Laser Welding Tool

Sponsor: LASAG Industrial Lasers

Sponsor's General Business Statement: LASAG is a market and customer driven company that designs and manufactures high quality precision lasers for various industries with the goal to be the most successful global supplier of industrial solid-state lasers for micro material processing.

Sponsor's Advisor, Title, and Phone Number: David Krattley, Regional Sales Manager, (715) 381-1412

Sponsor's Address: 1615 Barclay Blvd., Buffalo Grove, IL 60089

University of St. Thomas School of Engineering Academic Advisor: Dr. Greg Mowry

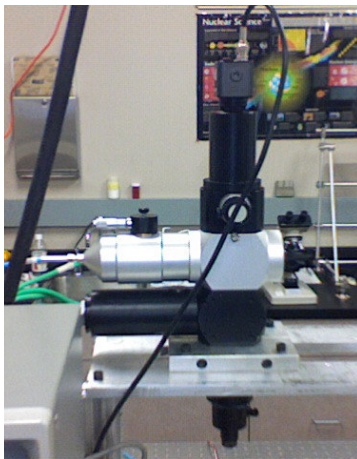
Team Member Names: Adam Urness (EE), Matt Jungwirth (EE), Janell Brown (ME), Matt Des Marais (ME), Justin Mensen (ME).

Senior Design Clinic I-II (ENGR 480-1) Project Description: Model and develop a control system that utilizes sensor data procured from light waves emitted by the weld pool to automate a welding process.

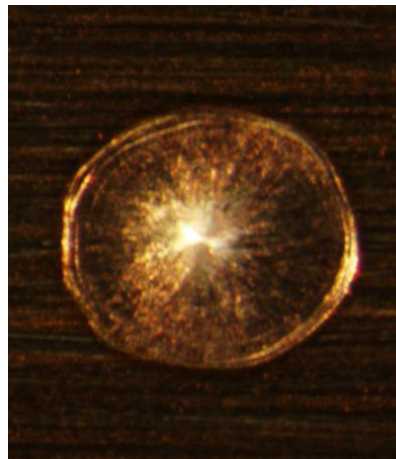
Major Design Requirements:

1. Develop a welding process that has zero bias and infinite repeatability.
2. Design and complete hardware required for supporting control system.
3. Computerized XY stage control
4. Mechanical design of sample holding fixture
5. Development of a feedback control system
6. Development of software for creating a reproducible welding process
7. Design of Experiments to characterize sensor output of optimal laser setting parameters

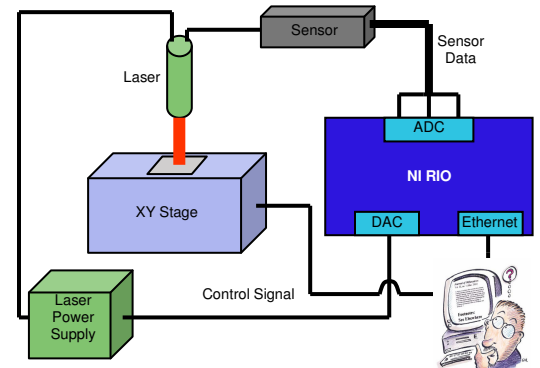
Senior Design Project Summary: The project proposal by LASAG, a leading manufacturer of industrial Nd:YAG lasers for material processing, was to build a system for the efficient welding of common metals and alloys such as steel. LASAG is currently doing such welding at a 30% efficiency using open loop pulse forming, but hopes to increase the effectiveness with a closed feedback loop. LASAG created the sensor that was used in the project, which consists of three photodiodes tuned to different wavelengths in order to measure the radiation from the work piece. The sensor separates the light originating from the weld spot into three signals that characterize the active weld pool. These signals are then analyzed by the control algorithm and a signal is sent to the laser that directs the laser output, completing the loop. The effectiveness of this redesigned process is tested with multiple techniques including visual analysis and destructive physical testing. As there is no real precedent for this type of laser welding, much of the work done has been exploratory and unique, as well as demanding.



LASAG Nd:YAG Laser and sensor system



200 Micron spot weld



System block diagram