Faculty of Electrical Engineering & Computer Science
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Sensing and Control of a Laser Surface Treatment Process by 2D High Accuracy Thermal Imaging.

ABSTRACT - Masterthesis

In this work a novel 2D high accuracy, emissivity independent thermal imaging system shall be implemented into a laser surface processing setup. The detector system contains a CMOS-chip with logarithmic characteristic (High Dynamic Range). Thermal radiation is detected pixel pair wise where each pixel of the pair is filtered to detect a certain wavelength. By calculation of the quotient of both signals the temperature can be evaluated according to Stefan Boltzmann, emissivity and geometric factors shorten out. The CMOS-chip contains an array of these pixel pairs and thus allows 2D temperature measurements. The determination of the temperature distribution is realized by a PC program.

Task of this thesis is to develop software to evaluate the temperature information provided by the camera system in terms of peak temperature and width of definable isotherms. On this basis a closed-loop control shall be set up. Depending on the interfaces and protocols of the system, adequate hardware has to be chosen and programmed. This step is to be executed under close consultation of the system manufacturer. The following parameters are to be enterable, visualized and protocoled: a region of interest within the process zone as well as laser power, peak temperature, temperature distribution and width and area of isotherms to be specified over time. The desired temperature and width of the isotherm as well as the control parameters have to be enterable and protocoled.

The function of the system is to be demonstrated by laser cladding with closed-loop melt pool width control. Single tracks with different feed velocities are to be clad at one desired melt pool width.