12:15
CThE5

Application of a copper laser monitor for the observation of laser induced instabilities during the treatment process of material

Klimovskii I.I.,Abramov D.V.,Galkin A.F.,
Prokoshev V.G.,Grigoriev A.V.,Arakelian S.M.

Vladimir State Technical University,
Gorkii str.87, Vladimir. 600026 Russia
Tel.:(092-22) 79621, 79847
Fax: (092-22) 33342
E-mail:wlad%rtf@vpti.vladimir.su

SUMMARY

Investigation of physical processes induced under powerful laser radiation interacting with surface of metal are very important to understand the mechanisms of the energy transport during the melting processes. The essential deviations from equilibrium state of the system are a vital point for discussed highly nonlinear phenomena. These deviations could not be described within the frameworks of common (weakly nonlinear) linearized dynamic models. First of all it is concern to such a most general and fundamental nonlinear problem as an excitation of stochastic and turbulent movement in dissipative systems and as a result the definite spatial and temporal structures (often with contrast to fluctuations) arise in considered nonlinear material.But experimental study of discussed phenomena during the melting process under powerful laser radiation as well as under development of electron-beam, electric arc and plasma technologies is limited due to absence of reliable methods for observation of zone of interaction where excited flows come out from the bulk to surface of illuminated material. In the first place it is connected with the formation of blazing plasma directly above the zone of interaction. The experimental unit reported by us for analysis of dynamic processes during the laser treatment of materials consists of two pieces, i.e. the laser technological plant and the laser monitor. The light amplifier of brightness constructed on the basis of a copper laser is a principal element of the considered system. Radiation of a copper laser (a copper laser operates without the mirrors) is directed in the region of fusion at the surface. Reflected radiation (collected by lens) passes through the amplification medium of the Cu-vapour laser and so, is amplified by the laser. Then the radiation is projected to the screen (or to the set of detectors). On the contrary, the amplification medium (i.e. a copper laser) lets simply pass of incoherent radiation of plasma and also of thermal radiation of the zone of interaction without any amplification. Our optical setup with computer control system provides to carry out a real-time visualization of investigated zone of the surface and gives an unique opportunity for diagnostics and control of temporal instabilities during the melting process in metal. The dynamic regimes of the melting process in metal have been studied in our experiment by described above technique and some mathematical modeling and simulation of obtained phenomena has been carried out on the basis of measured by us quantitative parameters. High accuracy welding technology of optical fibers with simultaneous control of the quality has been demonstrated as well by using of such a copper-laser monitor. The fact results in new technological approach for automatic production and control in optoelectronic industry.

11:00-12:30 **HALL 16**
CThF - Photonic Transmission and Networks
Presider: TBD

11:00
CThF1
(Invited)

Scalability Issues in WDM All-Optical Networks

Daniel J. Blumenthal
School of Electrical and Computer Engineering
Georgia Institute of Technology
Atlanta, GA 30332-0250
Tel: (404) 853-9448, Fax: (404) 853-9410, Email: danb@ee.gatech.edu

All-optical photonic networks offer the potential for bit-rate and format transparent communications. In this class of network, signals traverse the network without opto-electronic conversion at the routing nodes and may encounter multiple fiber links, multiple routing and regenerative components, and signals transmitted on other wavelengths. Due to the analog nature of these networks, the network capacity in terms of number of wavelengths and bit-rate per wavelength that can be supported will depend on the characteristics of the devices and the network they are embeded in. This limitation comes about from a complex interaction between the network architecture and its physical implementation and can lead to degradation in signal-to-noise-ratio and the usable optical bandwidth. Physical limitations that must be considered include bandwidth of the fiber and components, interchannel crosstalk (between wavelengths) due to nonlinearities in the optical fiber and optical amplifiers, incoherent and coherent interchannel crosstalk, and optical and electronic noise.

In a WDM all-optical network (AON), data can enter or exit the network at any node and it is desired that each link can support a fixed set of optical wavelengths. A combination of space and wavelength switching or routing is required to reduce the total number of wavelengths to below the number of nodes. In this talk we discuss the reasons why the total number of wavelengths that can be supported over a WDM AON is limited. We also discuss mechanisms that limit the maximum bit rate per wavelength, the internode distance, and the total number of nodes. The following related issues will be covered individually and then brought together in the context of a network architecture:

- Heterodyne crosstalk due to leakage in space photonic switches [1], leakage in add/drop nodes [2], four-wave mixing in semiconductor optical amplifiers [3] and in optical fibers [4].
- Homodyne crosstalk due to interferometric conversion of laser phase noise to intensity noise (PIIN) [5].
- Incoherent crosstalk due to fiber nonlinearities [6] and linear crosstalk in devices (e.g., demultiplexers, switches, etc.).
- Degradation of SNR and dynamic range due to optically amplified spontaneous emission (ASE) and amplifier gain saturation [7].

References

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