DISTRIBUTION OF LASER EMISSION IN SYSTEMS OF PRIMARY TRANSMITTIONS IN OIL AND GAS ENVIRONMENTS

Dorogonov D.I., Student; Bogomolov M.F., Ph.D., Associate Professor;
Drobyazko Y.I., Foreign Language Teacher
National Technical University of Ukraine
"Kyiv Polytechnic Institute", Kyiv, Ukraine

Subsea Oil and Gas production is undergoing major changes due to factors such as the move to exploit offshore fields located in deep water and the consequent need for deep water installations, the reduction in the number of discrete offshore installations via the use of long distance tiebacks and subsea processing. The industry also faces new challenges from increased environmental awareness and legislation. When combined with the on-going quest for improved efficiency as well as reduced costs and risk, it is clear that the industry faces significant technical challenges. A wide range of technological and operational developments are underway to enable the industry to develop the new improved hydrocarbon production systems required to meet these challenges. The overriding technological thrust is the development of a digital oil field or intelligent field that provides optimized hydrocarbon production. In essence the digital oil field system comprises a collection of technologies capable of collecting, transmitting and analyzing completion, production and reservoir data and providing operators with real-time information and remote control to optimize the production process.

Pipeline monitoring will be provided with advanced instrumentation that has been developed, proven and deployed in recent deepwater projects. Fiber-optic sensors and new data acquisition systems have been deployed to provide real-time pipeline and riser monitoring on a variety of fields. Fiber-optic sensors are ideally suited for subsea applications for several reasons: they have multiplexing capability, they are immune to electromagnetic interference (EMI), and they have very little signal loss over extremely long distances, small size, corrosion resistance, and ease of use and handling.

The study of optics light scattering is distinguished direct and inverse problems of light scattering. These problems make the theory of radiative transfer. The main goal is to determine the parameters of particles and medium components on the basis of transformed light field by the environment. This problem has a solution by means of mathematical calculations by solving the transport equation of radiation in integral-differential form. But in practice it is necessary to consider the picture, which brought the overall appearance of optical radiation interaction with the environment, which is investigated (for example, a mixture of water, oil, gas, sand, etc.) (fig. 1).

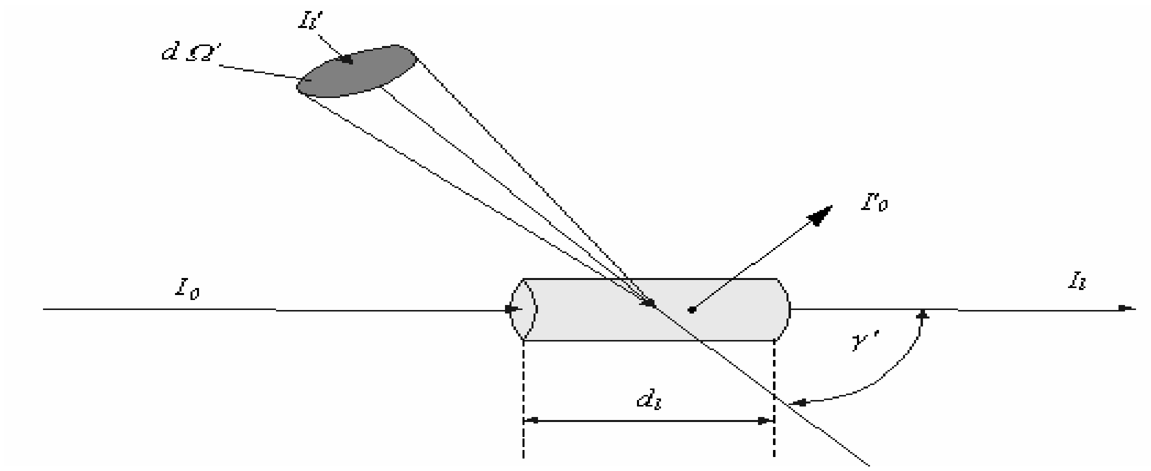

Fig.1. Interaction of optical radiation from the element of volume environment, where: I_0 - intensity incident on an elementary volume radiation; I_λ - intensity of radiation passed through the volume; I'_0 – own intensity radiation of element dλ; I'_l - the intensity of extraneous light source volume dλ.

On similar principles are explored the dimensions of pressure, temperature (fig.2), flow, content and number of objects of subsea production.

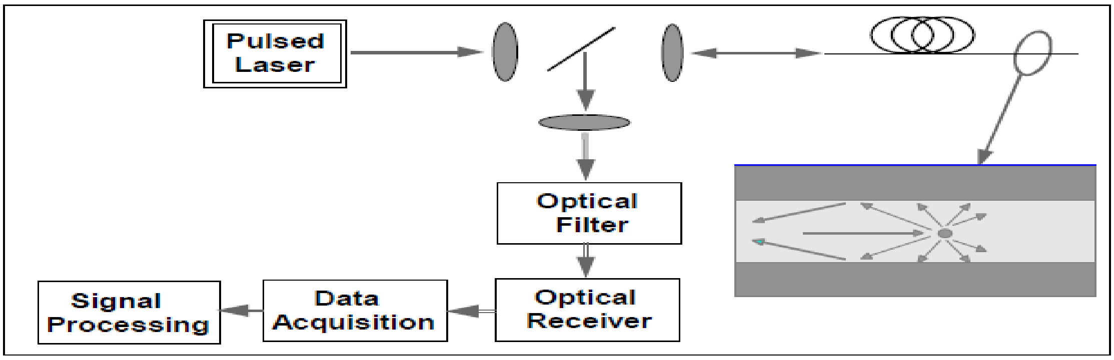

Fig. 2: Basic arrangement of a Raman Distributed Temperature Sensor

So, key features of fiber optic sensor are listed below: are lightweight and small in size; are rugged and have a long life—sensors will last indefinitely; re inert and corrosion resistant; have little or no impact on the physical structure; can be embedded or bonded to the exterior; have compact electronics and support hardware.

Literature

1. «Integrated Production Assurance for Subsea –A Strategy for Subsea Process Control Optimisation», G. High, The Oil and Gas Review 2006, Vol 2, P. 112-116

2. Павлов С.В., Кожем'яко В.П. та інші Фотоплетизмографічні технології контролю серцево-судинної системи. Монографія – Вінниця: УНІВЕРСУМ-Вінниця, 2007. – С. 40.

3. Let There Be Light. BP Frontiers On-line Magazine, April 2010.