Development of web-oriented cluster application for experimental data processing, received by ellipsometry method and X-ray reflectometry.

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Abstract:

By the Department of Applied Physics of Sumy State University has been developed web-oriented application on base of cluster for calculation of experimental data, received by ellipsometry method and X-ray reflectometry. A using of a cluster, as hardware’s base, was stipulated by the operation of big quantity of data. The application is based on conceptions of remote internet-laboratories and possibilities of graphical programming environment as LabVIEW. The base of data processing is a using of genetic algorithm. Also it was shown that the using of this algorithm give preferences over other methods in process of search of physical solutions in systems with big quantity of unknown parameters.

1 Introduction

Last years a conception of virtual, distance internet-laboratory (iLab) obtained a wide using. Such popularity has been condition by accessibility, simple architecture and, as major, possibility of experimental operation without direct access to subject of research. Communication part consists of web-server and special software that talk by LAN/Internet with real devices or developed program and also execute a list of service functions [1].

2 Web-oriented cluster application for experimental data processing.

2.1 A using of genetic algorithm for analysis experimental data, received by ellipsometry method and X-ray reflectometry.

Genetic algorithm is an adaptive method of searching that last years is widely use for solution of optimization’s tasks [2].

Ellipsometry is a physicals method of solid body’s research based on data, received during a changing polarization mode of light’s beam [3].

Method of X-ray reflectometry based on measurement of reflection power of X-ray by material’s surface near a critical angle of full external reflection. The results of the measurements can be use for research of structural and phase properties of materials [4]. Thus, software developed by us use combined genetic algorithm that allows to find physical solutions for modelled multilayer thin film’s systems. The program use synchronous...
experimental data, received by ellipsometry method and X-ray reflectometry. The main strategy of the algorithm is a searching such parameters of model as provide minimal difference between experimental and calculated data. For calculation of X-ray reflectometry was used some theoretical models. Among them: Parrate, interdiffusion, profile and model with replications. User oneself select necessary model. Correctness of calculations was checked up by GenX software [5].

2.2 A using of graphical programming environment LabVIEW for software development.

A graphical programming environment LabVIEW v 8.6 by National Instruments was used for software development. LabVIEW is a powerful and flexible software environment, which is widely used for a management of various devices, carrying out of measuring and analysis of the received data. The aim of this work was to develop software with possibility of remote operation and receiving of measuring results. This possibility was realized by technology of Web Service (RESTful), and Internet oriented software. It enabled to build a remote laboratory in which users could work by a LAN or Internet and using ordinary internet-browser without installing on the working computer of any additional software, for example, LABVIEW or Run Time Engine. In technology of RESTful an access to the Internet consists of a few levels of protocol: physical and software. A human-engineered interface was developed for user with using the package of programming environment Adobe Flex. A using of a cluster, as hardware’s base, was stipulated by the operation of big quantity of data. As a result it gave proportional increment of productivity in comparison with typical PC.

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