Special-purpose optical-electronic computer systems controlled by the images parameters

Veacheslav L. Perju

Department of Computer Science, Technical University of Moldova
Stefan Mare Av.168, Chisinau, MD-2012, Republic of MOLDOVA
Tel:(3732)248097, Fax:(3732)735279, e-mail: veaceslp@md.pims.org

ABSTRACT

Are presented the results of elaboration and investigation of the new class of the optical-electronic reconfigurable image processing computing systems(IPCS), based on the conception of the computing means with the architecture, controlled by the parameters of the input images. The systems are multiprocessor and refer to the class of functional-distributed. There is given a description of the basis model and 6 types of IPCS, based on usage of different optical processor, control computer. There are examined methods of computing processes organization in the systems, presented results of the time expenditures. Comparative analysis of systems is given.

Keywords: image, optical, electronic, system, processor, holographic, correlation

1. INTRODUCTION

Previously[1] by author the new concept of working out computer means the architecture of which is controlled by the parameters of the input images(CPI) was proposed. This concept is intended to organize the adaptive image processing based on extracting the exactly necessary volume of information from the initial image and its further processing as well as on redistribution of computer resources depending on the image parameters being analyzed.

Such an approach allows to organize the new trends of the researches: the elaboration of special-purpose computer systems with fixed and reconfigurable architecture CPI; general purpose computer systems CPI.

On the basis of proposed concept a set of optical-electronic image processing computer systems (IPCS) were elaborated and made. There is given a description of the basis model and 6 types of IPCS, based on usage of different optical processor and control computer (chapter 2). The elaborated systems are the reconfigurable functional-distributed computer systems. The possibility of architecture reconfiguration is provided by the operative reorganization of communications between different units and synchronization of their functioning. The organization of communications in the systems is executed with help of distributed commutator units which are placed in different systems units. In quality of the control computer there could be used built-in or external personal computer. In the

In *Optical Pattern Recognition XI*, David P. Casasent, Tien-Hsin Chao, Editors,
Proceedings of SPIE Vol. 4043 (2000) • 0277-786X/00/$15.00

systems it is possible to use optical Fourier-processors of 3 types: on the basis of photothermoplastic film, with joint Fourier transformation, and on the basis of matrix of semi-conductive lasers. There are presented the electronic and optical modules of the systems (chapters 3,4). In chapter 5 are presented different methods of computer processes organization in the systems, including cases when the analyzed image can contain one or group of the objects. There are presented results of time expenditures in the systems (chapter 6). Accordingly at the preliminary image complexity calculation and corresponding organization of the computer processes there exists a possibility of the time expenditures decreasing in the systems from 1.6 to 3.7 times. Comparative analysis of the elaborated systems is represented (chapter 7) taking into account the time expenditures, speed of functioning, the number of stored standards, necessity of preliminary recording of the holographic filters, flexibility of the systems their dimensions, consuming power.

2. THE BASIS MODEL OF THE IMAGE PROCESSING COMPUTER SYSTEMS

The basis model of the image processing computer systems contains (figure 1) processors of preliminary image processing (PPIP), processor of geometrical image transformation (PGIT), optical Fourier-processor (OFP), processor of correlation field analysis (PCFA), processor of image complexity determination (PICD), units of images super operative memory (UISOM), units of images operative memory (UIOM), distributor of control signals (DCS), commutator units (CU), control computer (CC), video data bus (VDB), digital data bus (DDB), TV camera (TVC), monitors M1-M4.

The elaborated system is a reconfigurable functional-distributed computer system. The possibility of architecture reconfiguration is provided by the operative reorganization of communications between different units and synchronization of their functioning. The organization of communications in the system is executed with help of distributed commutator units which are placed in different system moduls. Adjustment of the system and synchronization of its functioning is performed by distributor of control signals.

In quality of the control computer there could be used built-in or external personal computer. In the system it is possible to use optical Fourier-processors of 3 types: on the basis of photothermoplastic films (PTPF), with joint Fourier transformation (JFT), and on the basis of matrix of semi-conductive lasers (MSCL).

Constructively the system is executed in 2 modules: of the electronic and optical information processing. The module of electronic information processing consists on all electronic blocks of the system (including the built-in computer). Dimensions of this module are 300x400x250mm and of the optical processor are 600x700x250mm. (including power supplier units of all elements).

Depending on the type of used optical processor and control computer there were elaborated different modifications of the image processing systems (see table 1).