

The Information Filling of the Database by Physical Effects

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Abstract: In this study, information filling of the databases created on the basis of models of the description of physical effects is considered. The developed models of representation of physical knowledge in the form of physical effects allow to form effective databases on physical effects and on their basis, various automated systems of search of physical effects and synthesis of the principles of action for use in search designing of technical systems. Quantitative distribution of effects according to the main sections of physical knowledge is given in the massif, invariant to subject domains of equipment and in a number of object-oriented funds. Are described the importance invariant and object-oriented databases on physical effects. The features of information filling of databases of physical effects including as iterative nature of procedure of drawing up descriptions of physical effects and openness of the corresponding information support are given. The general technique of modification of databases on physical effects intended for adaptation of information support to the changing needs of users is presented.

Key words: Model, physical effect, information support, database, modification

INTRODUCTION

Efficiency of application of databases on the Physical Effects (PE) at the solution of practical tasks in the field of search design, invention, scientific activity and training depends on two factors: structures of representation of physical knowledge and concrete information filling (Fomenkov *et al.*, 2004; Fomenkov *et al.*, 2014a). Obvious that with growth of quantity of PE and expansion of extent of coverage of various sections of physical knowledge the value of a database increases in a database.

Global database of physical effects: On the basis of the offered models of the description of PE on chair “Systems of the automated design and search designing” of the Volgograd State Technical University the PE unique information array is created. A kernel of the massif is the set of PE, invariant to subject domains of equipment and sections of physics which received the conditional name “global database on PE”. The global database contains 1067 descriptions of PE and structurally consists of the following parts differing in ways of formation.

Structure of a global database of physical effects: Educational fund 211 PE, the fund included PE,

corresponding, generally to the program of a course of the general physics in the highest technical educational institutions.

Fixed assets 589 PE, the fund included the PE supplementing a course of the general physics and corresponding to special sections of physics. The largest sections of fixed assets is the following:

- Physics of metals (metallurgical science) 74 PE
- Physics of semiconductors 57 PE
- Physics of solid dielectrics 45 PE (including, physics of a ferroelectric material, segnetopoluprovodnik 22 PE)
- Optics (generation of electromagnetic radiation, wave optics, quantum optics, optical properties of substance) 85 PE (including, a luminescence 15 PE, lasers 14 PE)
- Physics of liquid 99 PE (including, liquid crystals 14 PE, liquid metals and fusions 19 PE, quantum liquids 5 PE)
- Acoustics (elastic fluctuations and acoustic waves, the acoustic phenomena in external fields, impact of a sound and ultrasound on substance, acoustic properties of substance) 29 PE
- Superconductivity 37 PE (including, high temperature superconductivity 4 PE)

- Physics of plasma 33 PE
- Physics of gases 14 PE
- The magnetoordered condition of substance (ferromagnetics, ferrimagnets, anti-ferromagnetics) 26 PE
- Kinetic (diffusion, ionic transfer, cross effects, transfer in external fields) and the contact phenomena in solid bodies 52 PE
- Issue (electronic, ionic) 14 PE
- The resonant phenomena 14 PE

The PE special fund made on the basis of information containing in demands for opening on physics 120 PE. The fund contains the following sections:

- Physics of metals (metallurgical science) 20 PE
- Physics of dielectrics 10 PE
- The kinetic and contact phenomena in substance 27 PE
- Issue (electronic, ionic) 5 PE
- Optics 19 PE
- Magnetic properties of a solid body (ferromagnetics, paramagnetics) 5 PE
- Physics of semiconductors 10 PE
- Physics of polymeric materials 8 PE
- Thermal properties of a solid body 3 PE
- Electric properties of a solid body 3 PE
- Loose environments (semistructured systems), rocks 6 PE
- Superconductivity 2 PE
- Physics of liquids 8 PE

The PE special fund made on the basis of information containing in new publications (1995-2012) in physical magazines 147 PE. The fund contains the following sections:

- Optics (generation of electromagnetic radiation, wave optics, quantum optics, optical properties of substance, interaction of electromagnetic radiation with substance) 23 PE
- Methods of receiving and property of nanocrystal and submicrocrystalline materials 41 PE
- Fullerenes and fullerene-containing solutions 4 PE
- Physics of gases 8 PE
- Physics of liquid and liquid crystals 8 PE
- The magnetoordered condition of substance (ferromagnetics, ferrimagnets, anti-ferromagnetics) 15 PE
- Mechanical properties of a solid body 13 PE
- Acoustics 11 PE
- Electronic issue and the resonant phenomena 7 PE
- Phase transitions and superficial properties of a solid body 17 PE

The importance of a global database on PE is defined by that due to invariancy of information filling completeness of coverage of various areas of physical knowledge is reached (universality). This circumstance is an important factor for expansion of a circle of the solved tasks and also elimination of stereotypes (by nonconventional application of known PE) and removals of “information barriers” at the solution of tasks (application of new PE or nonconventional application of known PE). The global database on PE forms also a basis for creation of the highly specialized databases focused on the solution of tasks in concrete subject domain.

Object-oriented funds of physical effects: Additions to a global database on PE serve the PE object-oriented funds (local databases on PE). We created three local databases on PE:

- The PE “Destruction and Management of Properties of Rocks” object-oriented fund 155 PE
- The PE “Diamond in Electronic Equipment” object-oriented fund 39 PE
- The PE “Receiving and Properties of Amorphous Materials” object-oriented fund 67 PE

Lists of effects of the majority of above-mentioned databases are provided by Fomenkov *et al.* (2004).

Features of information filling of databases of physical effects: It should be noted a number of the important circumstances concerning information filling of databases on physical effects

First, procedure of drawing up descriptions of PE isn't single and has iterative character. Need of revision of already created descriptions of PE is explained by a variety of reasons:

- Constantly, there is an operational information allowing to add, modify descriptions of PE on already existing models of representation of PE
- New models of representation of PE which demand attraction of wider information on structure are created

Secondly, one of the main opportunities of adaptation of the automated information systems operating with PE to a real task of the user is openness of their information support. The user has to have opportunity independently to create additional information support necessary for it, i.e., the PE corresponding object-oriented funds. We developed a technique of creation of such PE funds, it provides implementation of the following listed below

procedures in a general view. We will note that the technique is detailed for application in Russia but can be easily generalized for other countries.

Development technical and the software allows to lift earlier existing rigid limits on the volume and structure of information in descriptions of PE.

MATERIALS AND METHODS

Technique of information filling of the database of physical effects: The block diagram of a technique of formation of the PE object-oriented fund is given in Fig. 1.

Analysis of the existing array of physical effects: It is necessary to carry out search in the available PE array and to select all effects suitable for inclusion in the formed fund, according to its specialization. Search can be carried out by any of the ways which are in detail described in (Fomenkov *et al.*, 2004): on attributes a component of an entrance, object, an exit; on attributes a component

action, object of action, special conditions and restrictions of a search sign “practical application of PE”; on keywords in case of use of full text search. For completeness of search the combined use of various ways is recommended.

Selection of “primary” information: This procedure is central in the considered technique as “initial (primary)” information depends on quality as a result and quality of “final” information descriptions of FE. In procedure of selection of “primary” information the question of completeness of search is very important (not to pass valuable relevant information). For realization of procedure it is recommended to pay attention to the following sources of information.

Subject catalogs of the largest scientific libraries. Information publications on physics. The main edition such is the Refereed Journal (RJ) of the All-Russian institute of scientific and technical information “Physics”. Other information publications are the systematized

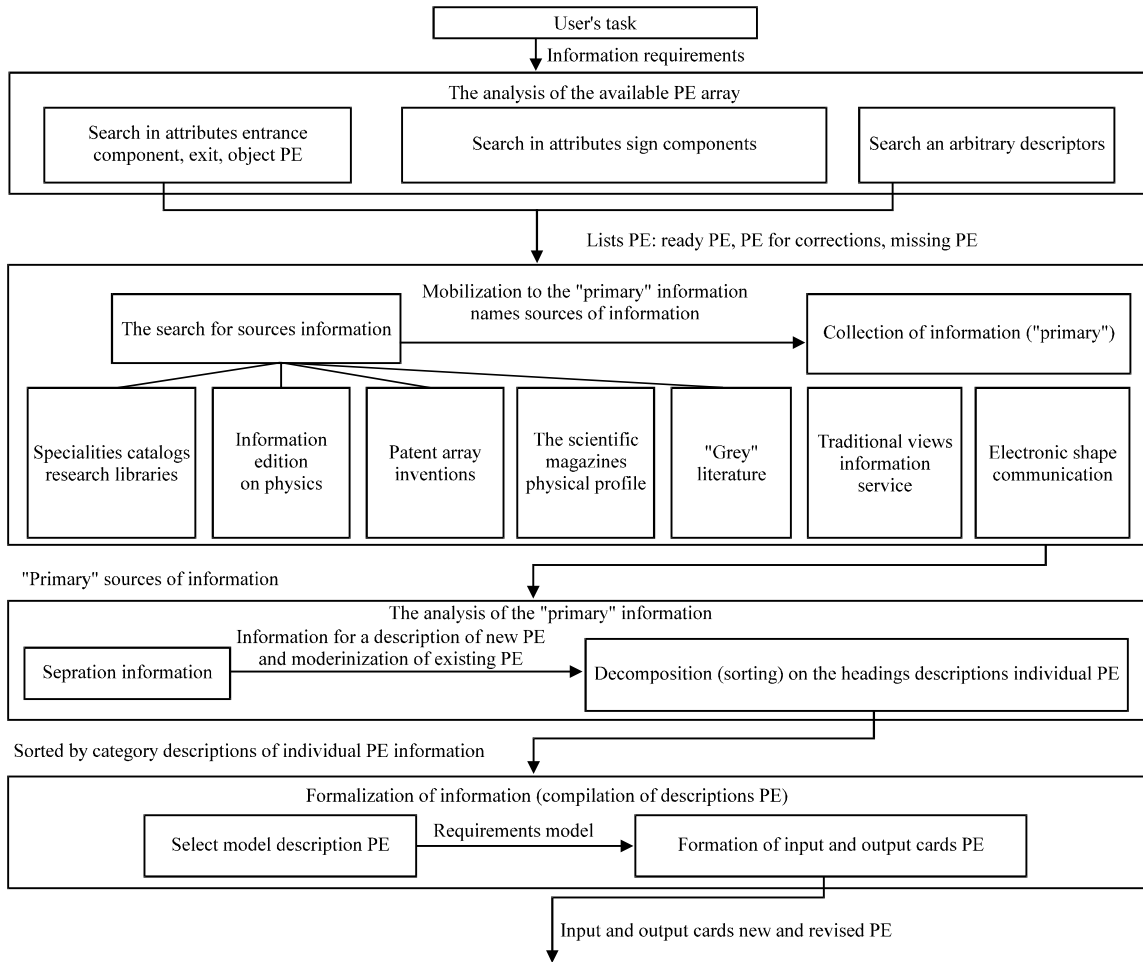


Fig. 1: Block diagram of a technique of formation object-oriented PE fund

bibliographic index in the form of bulletins of alarm information “Physics”, the cumulative systematized bibliographic index and a “database the bibliography+rubrikatsionny codes”. At a good choice of headings and attentive work with RJ “Physics” high degree of completeness of search of “primary” sources containing quite modern information is provided. For increase of degree of completeness of search it is recommended to increase quantity of the looked-through headings (expansion of search at the expense of adjacent areas of physics). In some cases if it corresponds to specialization of the formed fund, involvement of other abstract magazines for example of RJ “Chemistry” is expedient, RJ “Metallurgy”, RJ “Mechanics”, etc.

Patent array of inventions. It is necessary to study attentively the hierarchical rubricator of the International patent classification and to choose from it headings, the corresponding specializations of the formed fund.

Scientific magazines of a physical profile. It is necessary to study periodically contents of the central scientific physical magazines. Thus, special attention should be paid on magazines “Achievements of Physical Sciences”, “Magazine of Technical Physics”, “Physics of a Solid Body”, “Physics and Equipment of Semiconductors”, “Magazine of Experimental and Theoretical Physics”, “Engineering and Physical Magazine”. It is possible to attract also narrower specialized magazines, including in the scientific directions, related with physics if they correspond to specialization of the formed PE fund. It is necessary to carry to the advantage of scientific magazines that they contain the latest information which yet didn't find reflections in monographs, educational and reference books and also in various abstract editions (like the abstract magazine, express information, alarm information, etc.).

Unpublished sources (so-called “gray literature”). It is necessary to study in recent years bulletins of the All-Russian scientific and technical information center according to master's and doctoral dissertations and also collections of papers of open research works and developmental development. These sources of information can contain in the concentrated look valuable information of factual character.

The considered procedure has to come to an end with direct collecting all information chosen in various ways. Are for this purpose used as traditional forms and types of information service and electronic means of communication and access to domestic and foreign databases. First of all, we pay attention to possibilities of the global Internet network.

Analysis of the “primary” information: Essence of this procedure is the analysis of all collected information and its sorting. First of all, it is necessary to make division of information into two big groups. The first group contains data for the compilation of descriptions of new PE, the second for modernization of the existing descriptions of PE. Information of the first group is classified by individual PE (allocation of various PE), information of the second group by headings of descriptions of the existing PE.

This operation is difficult formalize and ambiguous. Owing to these reasons for its performance only recommendations of the general character can be made. The description of these recommendations is provided in (Fomenkov *et al.*, 2004).

Compilation of descriptions of physical effects: On the basis of the sorted result in the previous procedure information is a description of input and output cards of new PE in accordance with the selected model representation PE as well as the modernization of (clarification, addition, expansion) of existing descriptions of PE. Detailed guidance for the compilation of descriptions of PE using a variety of representations PE are given in (Fomenkov *et al.*, 2004).

We will note that at concrete realization of the presented technique separate procedures can be carried out in a short form or even to skipped.

At integration of again created PE object-oriented fund into structure of the general DB of PE it is necessary to realize additional procedures: input of descriptions of PE in the computer, verification of a DB of PE, correction of a DB of PE which form in total a technique of correction of a DB of PE at inclusion of new funds. In Fomenkov *et al.* (2004) the description of procedures of this technique is provided. Association of procedures of techniques of creation of the PE object-oriented funds and correction of a DB of PE at inclusion of new funds allows to create the general technique of modification of a DB of PE intended for adaptation of information support to the changing needs of users.

Owing to that the majority of procedures of this technique is rather labor-consuming, we made considerable efforts on automation of these procedures (Korobkin *et al.*, 2013; Fomenkov *et al.*, 2014b; Korobkin *et al.*, 2014) in recent years.

RESULTS AND DISCUSSION

Efficiency of application of databases on PE at the solution of practical tasks is defined, in many respects by information filling: structure and quantity of PE. Based on

the proposed models describe the PE array is formed by a unique information PE. The core of the array is invariant to the subject areas of technology and branches of physics set of PE, affectionately called “global database on PE” (1067 descriptions PE). For each part of a global database quantitative distribution of PE according to the main sections of physical knowledge is given and the description of techniques of formation is given.

Additions to a global database on PE serve the PE object-oriented funds. In research, techniques of formation and structure (distribution of PE according to various sections of physics) three local databases are considered.

CONCLUSION

Adaptation of the automated information systems operating with PE to a real task of the user has to provide openness of their information support that is opportunity independently to create the PE object-oriented funds necessary for the user. In research, the technique of creation of such PE funds is stated. The technique provides implementation of the following procedures in a general view:

- The analysis of the available PE information array, mainly, a global database on PE
- Selection of primary information from references (mobilization of primary information)
- Preliminary processing of primary information for the compilation of descriptions of PE (the analysis of collected information and its sorting)
- Compilation of descriptions of PE or modification of the existing descriptions of PE according to the selected model of representation of PE

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