

# Problems of information support in scientific research

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**Abstract.** This paper reports on the creation of the open access Akustika portal (AKDATA.RU) designed to provide Russian-language easy-to-read and search information on acoustics and related topics. The absence of a Russian-language publication in foreign databases means that it is effectively lost for much of the scientific community. The portal has three interrelated sections: the Akustika information search system (ISS) (Acoustics), full-text archive of the *Akusticheskii Zhurnal* (*Acoustic Journal*), and ‘Signal’naya informatsiya’ (‘Signaling information’) on acoustics. The paper presents a description of the Akustika ISS, including its structure, content, interface, and information search capabilities for basic and applied research in diverse areas of science, engineering, biology, medicine, etc. The intended users of the portal are physicists, engineers, and engineering technologists interested in expanding their research activities and seeking to increase their knowledge base. Those studying current trends in the Russian-language contribution to international science may also find the portal useful.

**Keywords:** internet resources, information search systems, databases, acoustics, Russian-language sources

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## 1. Introduction

The information technologies for processing large information arrays and creating mechanisms for their presentation to users — research workers and engineering technologists — have been developed since the 1980s, and they were needed long before. The development of information technologies soon became a priority trend because of the then existing information collapse due to a sharp decrease (by one or two orders of magnitude) in the circulation of scientific journals, the rising prices of subscriptions to them, and, consequently, a considerable reduction in the number of libraries that received these issues. The thousands of printed copies of prestigious scientific journals avalanched to hundreds. For example, the journal *Uspekhi fizicheskikh nauk* (*UFN*) is now issued in 500 copies, whereas in 1985, as in 1931, it had 4000 copies. For *Akusticheskii Zhurnal* — 100 and 1850 copies, the composite volume ‘Fizika’ of the Abstract Journal (AJ) VINITI (All-Russian Institute of Scientific and Technical Information) of the Russian Academy of Science (RAS) had in 2015 20 (twenty) copies — to be compared with 1300 copies in 1985. This information refers to October 2015, but actually already from the early 1990s the era of printed scientific journals ended for the numerous armies of researchers. The time has passed since the Soviet AJ had been so popular that in the late 1950s–early 1960s some American firms addressed VINITI of the USSR AS asking for an overall translation of AJ into the English language and for it to be in western countries [1, 2]. A similar proposition was made in the late 1980s by the British media magnate R Maxwell [3].

In the past 25 years, we have increasingly been losing the possibility of getting acquainted with work accomplished for which scientific journals and AJ were, apart from conferences, the only source of information for research workers, save their personal contacts.

One of the ways out of such a situation is the creation of network resources and the provision of free (or at least not

expensive) access to them. The scientific research support consists not only of financing, which is, by the way, absolutely insufficient now, but also of the exchange of information, whose on-line presentation is of importance in many cases. Naturally, the most effective open access to information has antagonists [4], and it is these antagonists who have led us, directly or indirectly, to the abasement of AJ VINITI of the USSR AS.

The present paper describes one of the internet resources, namely, the Akustika information portal (<http://akdata.ru>), a package of one information-search and two information systems which are interrelated and provide access for both Russian and foreign researchers to Russian-language sources of information on acoustics.

The Akustika Russian-language information portal has been developed in the framework of RFBR grant 12-07-00732-a and is now filled and developed by researchers from the Physical Faculty of M V Lomonosov Moscow State University. This information system was created on the initiative of academician O V Rudenko.

## 2. Structure of the Akustika portal

Most scientific journals are not devoted to one narrow research area such as *Akusticheskii Zhurnal (Acoustic Journal)* or *Astronomicheskii Zhurnal (Astronomical Journal)*, but publish studies on diverse fields, like *UFN* and *ZhETF (Journal of Experimental and Theoretical Physics)*. For this reason, concrete readers may be interested in only some particular papers. For instance, the acoustic theme is scattered over more than three hundred Russian-language journals. For the researcher, it is virtually an unsolvable problem not only to read but even to look them through. The Akustika portal gathers information from all available sources, including periodicals, books, proceedings of conferences, and seminars. It serves both as the archive of *Akusticheskii Zhurnal*, which is the only Russian academic journal devoted entirely to acoustics, and also as ‘Signal’naya informatsiya’, providing insight into the present-day state of acoustic research in the Russian-language world. Hence, this information portal with a unique database (DB) containing information about publications on acoustics of both current and retrospective content is the only one of its kind. It fully meets the aim of our work, i.e., yields the information product of Russian-language papers and can most comprehensively reflect this research area and in its capacity completely satisfies the needs of specialists.

### 2.1 Structure of the starting page of Akustika ISS

The main advantage of an information system is the possibility of efficiently searching for necessary information by one or several parameters at a time. In this connection, the crucial part of any internet resource in the user interface. Judging the interface quality is quite a subjective thing, and paper [5] presents a whole number of criteria used to construct the current user interface of Sokol ISS of VINITI RAS. Some time ago, this institute was the standard bearer in information elaboration and products. However, as we have repeatedly written [3, 6–8], the interface of its ISS is inconvenient to use and overloaded by additional conditions, and the user has to undertake a long succession of actions to obtain the needed information [9]. One could obviously put up with all this, but the VINITI database is not popular because of fees for access, the contamination of the database itself, the lack of complete-

ness of included sources, a low quality of editing of available information and inefficiency of its presentation [6, 10, 11], etc. All this reduces the need to use this ISS. In this connection, it is satisfying to note that our criticism turned out to be effective, and the interface of Sokol ISS was revised, the option of a morphological search appeared, and, finally, the interest, although faint, in the work on the analysis of database replenishment appeared [12–15], but all this is certainly not enough.

Having some experience in creating of different information systems and working places to introduce and correct information, its editing, and work in ‘user’ mode [16, 17], we decided in favor of an interface of ‘minimalistic style’, which is necessary for the majority of users. Users have everything they need before their eyes rather than on different pages of the interface, and minimum number of ‘clicks’ suffice to start the search (see <http://akdata.ru>).

The user can introduce the name of the source, and already with three introduced symbols a prompt emerges specifying each next character. If the user sees the required edition on the list, it suffices to click on it, and the result follows.

For example, let’s say it is *UFN*. If the rest of the fields are not filled, the search will give 260 documents—this is the number of papers on acoustics published over all the years of the existence of the journal (1918–2015).

Next, one can introduce the year (or a period) over which the search will proceed or the volume and number of the issue if the information is being sought in a periodical. The next field is ‘authors’, then ‘keywords’, and ‘item’. One can fill in all the fields or only some of them. The system will indicate the total number of documents found and produce the required information, but it shows no more than 100 documents. One then has to specify the parameters of the search. The simplest way to do so is to define more exactly the years or add the authors’ names.

Incidentally, for the overwhelming majority of authors, this is sufficient. Authors who have more than 100 papers on the list make up 0.03% or 10 people as of the end of 2015. Note that the name of the author is written in the system database according to its spelling in the cited paper, and therefore, for example, the names ‘Kleshchev A A’ and ‘Kleshchov A A’ may belong to one author, but you cannot be quite sure. For English-language ISSs, such a discrepancy in spelling (transliteration) of Russian-language names presents a great problem, and our authors thus lose much both in searches and in determining their citation index, which is reported in papers [18, 19].

Incidentally, as to searches by keywords, in our opinion, they are useful if the search goes across the entire text of the paper or at least by the title and the summary. Their publication for each paper, which is required by almost all editorial boards of scientific journals, with their consequent introduction into the database, is a rather contentious affair, since these several words are written by the authors arbitrarily on the basis of their own understanding of which of them should be keywords. If the authors of papers at least made use of descriptor dictionaries for indexing their documents, it would still be a standard.

We concerned ourselves with the question of correct indexation at VINITI in the Department of Scientific Information on Physics and Astronomy [16]. The fact that the editors were supplied with descriptor dictionaries led to a sharp decrease in the spread of versions of keywords. Later

on, the problem of keywords was noticed in the center of information system development of VINITI [12, 13]. According to their data, in a batch of 5.5 million keywords, 61% were encountered only once (!) and another 14% only twice. Hence, it is much more efficient to seek by the title and summary and even better by the entire text. True, we will have to make some approximations till we are finally able to formulate correctly and accurately our request straight away.

Our information system also allows searching by an introduced itemizer. The itemizer itself, just like the ‘source’, appears as a prompt after a click on the input box. The itemizer has 16 items, most of which are divided into subitems. A search by itemizer is, in our opinion, of paramount importance, because the user can glance over the majority of papers on the subject. If you wish, you can also move via a hyperlink to those items which the editor thinks of as related or get all the papers of each of the authors. Note that the itemizer has three levels if the first is considered the name of the topical area Akustika. The experience of our work at VINITI shows that three levels are sufficient, whereas the urge to increase them, which before had been thought of as an achievement in the area of physics and had reached six to eight, resulted in quite an inadequate picture in item topping-up. Some of the ‘sleeping’ items waited for years until a new paper appeared in them. As a rule, it depended on professionalism, ‘taste’, and the responsibility of the editor and was inconsistent with the actual state of the art in physics.

## 2.2 Issuance of “Results of searching in the database”

The issuance page presents a complete bibliographic description of a document with a summary or an abstract. A bibliographic description is currently supported by GOST (State Standard) P 7.0.5-2008, but an increasing number of Russian editions are no longer guided by it [20]. In the framework of our project, we make use of the standard which we accepted earlier for the issues of AJ ‘Fizika’ in the VINITI division of physics and astronomy.

All the authors, items, and, in the case of *Akusticheskii Zhurnal* and some other sources, the titles of papers are supplied with hyperlinks, which makes it possible to go to pages of the latest papers of a given author (up to 100), to pages of the latest papers of a given item (also up to 100), or to the pdf version of the full text of the paper if it is available in the system.

The lists of author’s papers or documents in items are formed automatically from the database documents of the portal. With DB filling, their content also changes. The current DB packing consists of nearly 40 thousand documents covering the period from 1988, and in *UFN*, *Akusticheskii Zhurnal*, and some others, the DB contains all the papers on acoustics over the entire time of their existence. As of October 2015, 36,272 authors were in the system. Thus, the user gets all the papers on acoustics from a given edition, or of any particular author, or the papers of the author from a particular source, or the author’s papers over given years contained in the system, or papers in a particular item, etc. For example, as we have already said, during the whole *UFN* lifetime, they published 260 papers. Leading in the number of publications in the *Akusticheskii Zhurnal* with original papers in October 2015 are Lyamshev L M (112), Lapin A D (107), and Rudenko O V (99), and in the first number, i.e., 61 years ago, this journal published the paper “On the general relation between absorption and dispersion of sound waves” by V L Ginzburg, a future chief editor of *UFN*.

## 2.3 Issuance of information to the database

The technological database is filled from working stations with possible remote access (through the Internet). Three levels of access exist, namely, assistants at information input (input, itemization, and editing of documents in database), issuing editors (check of the results of formally logical control, formation of issues of signaling information), and administrators (service operations with the DB).

The DB of Akustika ISS is a ‘facilitated’ and reconstructed version of a technological DB optimized for a search for bibliographic information. Synchronization of these two databases is done by the administrator of each issue of signal information.

Issuance is possible by 10 types of documents, from serial issues to maps and atlases. Most of the documents are of course papers from periodicals (type 1–83%), then come talks at conferences, papers from books (type 4–15%), and books themselves (type 6). Other types of documents, such as standards, patents, and prospects, appear very seldom.

The Akustika portal has access points to the full-text version of *Akusticheskii Zhurnal*, the structure of whose site is described by us in [21], and to ‘Signal’naya informatsiya’ (SI) [10]. The site of the archive of *Akusticheskii Zhurnal* presents, along with scanned images of all issues of the journal, the content of each issue with a summary; each paper is itemized and placed not only in the contents but also in the corresponding item. An author index also exists, which gives the titles of papers and their datelines. All this is connected with cross hyperlinks, which facilitates searching and issue to a needed paper from any index. On the top right there are buttons to go to the preceding or the following issue of the journal. This option seemed to us very convenient. Placing the journal archive on the Internet, as we expected, considerably raised the number of citations of journal papers together with their impact factor within three years.

The internet archive of *Akusticheskii Zhurnal* (<http://www.akzh.ru/>) has a search system not only in Russian, but also in English. In [21], we present a three-dimensional graph showing the item content according to the year of the issue. It can be seen how the filling of the themes changes with time. Such data can also be used as a means of historical analysis of the development and prognosis of certain studies.

The site of ‘Signal’naya informatsiya’ (SI) (<http://akinfo.ru/>) is realized as an information system on the current section of issued publications on acoustics with a two-month periodicity. The SI preparation technology is also used for editing the introduced archive information. The SI is useful, for it makes it possible to glance over the current state of acoustic research in different areas. The site provides searches by sources, authors, and itemizers, and also allows looking through an issue as a whole in pdf format. Almost simultaneously with the issue of each SI number, and since 2013 18 issues have come out, its information goes into the Akustika ISS.

Another argument in favor of creating an information Internet resource such as ‘Signal’naya informatsiya’, is associated with the lack of complete information on scientific research in the Russian-language world. Only a small number of articles by Russian scientists appear abroad in the English language. Their share is negligible, even considering the latest tendency, i.e., some of our scientists submitting their work for publication in foreign journals. Publications in regional journals, proceedings, and bulletins and other limited editions are difficult to access, although they are for the most

part available on the Internet. Searching for them takes much time and requires the corresponding qualifications. To go farther and find a complete text of a paper is then not difficult if the bibliographic reference is known, which is just present in ‘Signal’naya informatsiya’.

#### 2.4 Access to the portal resources

Sought-after Russian-language internet resources of scientific information should, in our opinion, now be mostly free of charge. Otherwise, their users are quite few, which is demonstrated by VINITI RAS. The printed versions of its *Abstract Journal* are issued in about twenty copies. Even at M V Lomonosov Moscow State University they receive only one copy of the collected ‘obligatory copies’ coming from the Russian Book Chamber, while the electronic version of this edition is unavailable. This is how we are informed by the site of the Scientific Library of M V Lomonosov Moscow State University [22].

At the same time, free versions of the following scientific internet resources are always a success: *UFN*, *Akusticheskii Zhurnal*, *Zhurnal Eksperimental’noi i Teoreticheskoi Fiziki*, journals from the A F Ioffe Physical and Technical Institute, the Siberian Branch of RAS, Math-Net.Ru mathematical portal, and eLIBRARY.RU scientific electronic library. The last reports on over 10 thousand Russian journals now being processed, of which 3300 journals offer free access. Free is access to the information gathered at the Akustika portal, including complete texts of the papers from *Akusticheskii Zhurnal*.

#### 2.5 Search procedure on the Akustika information portal

The advantage of a modern information system over a simple set of files with papers (which each researcher tried to do when the PC appeared), bibliographical index cards (collected by each of us), or copies of papers that we managed to ‘fetch’ in a scientific library is the captivating possibility of immediate searching for necessary information by several parameters simultaneously.

*Search for publications.* This is what we normally need. Such a search can be accomplished in different ways. The simplest way is to introduce to the area ‘Keywords’ the title of the publication (several successive words from the title are sufficient), and you will almost certainly get the publication at the very beginning of the list. The other fields need not be filled in. Different publications with the same title are encountered very rarely. This typically happens if authors place versions of the same paper in different editions, for instance, in proceedings from a conference and in a periodical.

*Search for authors’ papers.* If you do not remember or do not know an exact title, you can seek by the author or authors. When more than 100 papers are received, the year of publication (several years) or the name of the journal must be specified.

*Search for papers on acoustics in journals.* One should introduce the name of the journal in the ‘source’ field or choose it from the appearing list. When more than 100 papers are received, one should specify the year (several years) of the publication.

*Search by itemizer.* In the field ‘item’ one should point out the item from the appearing menu. If specification is needed, one should indicate the ‘subitem’ from the appearing menu. In some cases, with such a specification one comes across over 100 papers. Then it suffices to name the authors or to give the interval of years.

### 3. Other Russian-language information resources in the field of acoustics

#### 3.1 Journal sites

Our study shows that a rather large number of Russian-language journals now have sites on the Internet. As a rule, these sites have an ‘archive’ section containing contents and sometimes a whole issue or separate papers of the journal with a nearly 10-year retrospective or even much longer for some journals, for example, for *ZhETF*, whose archive is continuous and goes back to 1961; however from 1961 to 1993, inclusive, it was only accessible in the English translation or on the *UFN* site, with a complete archive of the journal over its whole lifetime since 1918.

On such sites, an information search is, as a rule, impossible or yields minimal results; we cannot characterize them as information search systems, but such sites are undoubtedly useful, especially if they present abstracts of papers, to say nothing of full texts.

#### 3.2 Sites of journals and publishing houses — information search systems

The existence of at least the simplest search widens considerably the information possibilities of journal sites. This is, as a rule, one window offering a search over all the published issues, which is indicative of the existence of the journal database. And it is quite good when the journal papers are itemized.

So, the *UFN* site is a fullfledged information search system with itemization according to PACS (Physics and Astronomy Classification Scheme) and the feasibility of search also by authors and keywords. All the issues of the journal from 1918 are located on the site, which contains nearly 12,000 papers and notes. The same opportunity is offered by the site of *Akusticheskii Zhurnal*, which is also structured by issues, authors, and items and includes all the journal issues with 8700 papers, notes, referee reports, etc.

We should also note the journals from the A F Ioffe Physical and Technical Institute, whose archive reached 1988. The same institute also supports several topical databases. The Siberian Branch of RAS presents rather fully over ten journals of interest for us.

Periodic editions are well presented in the eLIBRARY.RU scientific electronic library, and information on the corresponding subjects can be found on the All-Russia mathematical portal Math-Net.Ru [20]. These have a rather convenient, although somewhat overloaded, interface. As an itemizer, Math-Net.Ru employs UDC, which is typical, obviously historically, of mathematicians only. Separate papers are indexed also by Mathematics Subject Classification (MSC 2010)—the Subject Index classification on mathematics or PACS. However, searching using them is missing.

The Scientific Electronic Library has no itemizer in the form that would allow estimating its quality. At the same time, this resource provides functioning of the “Russian index of scientific citation” (RISC), which, in our opinion, breaks new ground in informatics from Russian-language sources.

Access to both these resources is free of charge and the content over the past one-two decades is good. Both resources are effectively replenished. It is surprising why the large staff of the not too badly furnished specialized institute VINITI of RAS has failed to realize all these products.

Somewhere in 2011–2012, on realizing that it could not support the content of its AJ itself, VINITI of RAS took a decisive step in line with the traditions of those authorities who are unable to cope with a situation themselves: if one fails to increase the content, one can reduce the plan. And the annual filling was decided to be 700–750 thousand documents instead of 1.5 million, as in the 1980s. In 2012, VINITI undertook cooperation with the Scientific Electronic Library. This, however, did not help and the filling continued to decrease.

We recall the headings of the documents in AJ written totally in capital letters, which is in practice with the Scientific Electronic Library and looks absurd in the AJ style. Here, we do not touch upon the quite useful TOR software technological complex [23] developed through the initiative and under the guidance of A Ya Rodionov. But what then remains of VINITI RAS if the Russian-language part of its AJ is filled with the Scientific Electronic Library and the English-language part is present in the Web of Science or Scopus in an incomparably more complete version?

## 4. Prospects of the Akustika portal development

### 4.1 Creation of a Russian-language database in physics

Although foreign information-search systems such as Web of Science, Scopus, SciFinder (Chemical Abstracts Service), and even Google Scholar are well filled, sufficiently effective, and diverse, they cannot provide a somewhat comprehensive search through Russian-language editions. They are presented there in a rather limited amount and, therefore, are accessible to neither Russian nor foreign reader, except for journals translated and issued by foreign publishers. But will the above-mentioned information sources also wish to possess Russian-language editions? Undoubtedly yes, but they themselves will not seek or fill in Russian-language editions. It is too expensive a thing. They want ready batches of our abstract data.

The situation may turn out to be a dead-end for our research workers if the access to foreign resources is blocked for Russian users or the price rises drastically, which are already taking place because of the sharp drop in the exchange value of the ruble or for political reasons. It would perhaps be much more efficient both for them and for us if we exchanged abstract data on a mutually beneficial basis. This is perhaps one of the ways, at least for physics, to resolve the present-day situation with the applied sanctions on the side of the West and Russia, while science is international.

### 4.2 Extension of the list of sources employed.

#### Retrospective part

At the present time 325 journals, conferences held in Russia, and books issued by our publishing houses and those of the CIS in the Russian language are used to fill the Akustika information-search system. Moreover, the retrospective portion has now reached 1988, except for some journals such as *UFN* in its acoustic part and *Akusticheskii Zhurnal*, whose content covers the whole time of their existence. That is why, along with the introduction of current issues, the retrospective portion is constantly extended to accessible time intervals. In this connection, we extend our activity in what concerns work with certain research workers through the introduction to the DB of their work that is unknown to us. The authors can send bibliographies of their published

papers (together with abstracts), having preliminarily checked that they are absent from the system.

## 5. Conclusion

The amount of information describing the state of the art of modern science is so large that it seems impossible even to take into consideration this information without applying present-day information technologies. Therefore, together with the traditional theoretical and experimental methods of studying the surrounding world, the latest databases which are a constituent part of information-search systems began to appear as a new tool of scientific knowledge. Different successful attempts in stating and solving of scientific problems making use of contemporary DBs suggest the occurrence of a new scientific trend consisting of the elaboration of methods of an intensional analysis of large information batches and obtaining on their basis new knowledge about the surrounding world and its laws.

The technologies designed by us are, in our opinion, a completed system of information provision of acoustic studies. The key link is the Akustika information-search system, which allows an intuitively clear many-parameter search not only for publications, but also for the results of research, performed experiments, and applied methods and solutions. Note also that, besides being and a simple presentation of information, the Akustika portal allows one to do work on the study of the current state of acoustics and obtain data for a consequent analysis of tendencies in the development of one field or another of acoustics [7, 21].

The system can be extended or, as is now popular to say, scaled to other fields of knowledge, first of all physics and astronomy. As the first step in keeping our scientific heritage and extending our resource to all of physics, we introduced into it a full-text batch of “Itogi Nauki i Tekhniki” on physics and astronomy that have been issued since the 1950s at VINITI of the USSR Academy of Sciences and were organized by leading specialists, each in their own field. The last volume appeared in 2008. As the second task of our portal, we are planning to retain our scientific heritage and priority of the country in our field of activity. Academician V L Ginzburg said that a biological presence is necessary in science for forwarding our ideas and obtained results of studies, since the discoveries themselves are not always eloquent enough. We believe that the ‘biological presence’ should be supplied with information-search systems. The work (document) should be indexed correctly in them, which will provide its ‘presence’ and priority. In our country, we initiate noisy campaigns on looking for and punishing an unlicensed use of western products, while we do not take care to retain and secure our products.

Qualitative research work at the modern level that suggests obtaining priority results is unthinkable without information support. We should not look at the obvious decay of state information services as alien. We are obliged to take care of ourselves, i.e., of physics, as was done by mathematicians. The staffs of our leading universities and scientific organizations, along with the Division of Physics and Astronomy of RAS, could head the information support for physics in the Russian-language world. This is, to a certain extent, our mission. We are losing or, more precisely, have already lost a noticeable part of the world stream of scientific information over the past quarter of a century, which was previously reflected in the AJ VINITI of USSR AS. However,

with the help of foreign specialists, it was not lost in the areas where their efforts were made. But we risk losing and, perhaps, have already lost our Russian-language heritage. It is absent from foreign databases.

Incidentally, it is not only physicists and mathematicians, but also biologists discussing the loss of ‘Russian-language content’, which can be seen in the paper by E Lysenko [24].

Thus, the nearest task is to supply physicists with current information over the entire spectrum of Russian-language editions and continue to convert retrospective information into the digital form (before the printed edition in the collections of our libraries are lost).

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