Credit: Marijn Heule

Everything in Its Right Place
An Expert Guide to Searching with MathSciNet

Edward Dunne

Most mathematicians are familiar with MathSciNet and have some idea how to use it. However, we are generally self-taught. A few graduate programs will go over MathSciNet with new students, but such introductory courses are rare. I work at Mathematical Reviews, where we make MathSciNet and use it a lot. Since coming here, I have learned some really great things about searching the literature with this tool. With this article and its sequel, I will share some of the most useful things I have learned. The column turned out to be longer than initially planned. As a result, the column will be published in two parts. This first part will cover some generalities and the most popular type of search. The second part (which will appear in October) will describe Author Searches and Journal Searches, including descriptions of some big changes in our Journal Profile Pages.

MathSciNet is the user interface for querying the Mathematical Reviews Database (MRDB). The database has been built up from the editorial work done at Mathematical Reviews ever since its first publication in 1940. The MRDB has been supplemented by data from various retrodigitization projects, with the oldest entries dating from 1810. In this article, I provide an overview of how to use MathSciNet. It seems fair to assume that most readers are familiar with searching databases, such as Google, amazon.com, library catalogues, or the arXiv. Many of the features of MathSciNet searches echo searches provided by other databases. I try to go into detail on topics that are distinctive and provide sketches on topics that are more self-evident. There is more information about MathSciNet in some of my blog posts: https://blogs.ams.org/beyondreviews.

There are three primary searches in MathSciNet, corresponding to the three major parts of the database: authors, journals, and publications (papers and books). Each type of search works somewhat differently and returns different results. By far, the most common search is for publications. Indeed, over 80% of the initial searches on MathSciNet are publication searches. Author searches represent about 15% of all initial searches. Journal searches make up the rest. You initiate one type of search or the other by starting at one of the first three tabs in the main search page, seen in Figure 1.

Note: in what follows, I will provide counts of matches resulting from searches. We update the MRDB hourly, so these counts will change with time. The counts provided here are for searches done in May 2019.

Publication Search

A publication search looks for journal articles, conference proceedings articles, theses, books, and collections. It is a fielded search with 14 possible fields: **Author**, **Author or Related**, **Title**, **Review Text**, **Journal**, **Institution**, **Series**, **MSC Primary**, **MSC Primary/Secondary**, **MR Number**, **DOI**, **Reviewer**, **Anywhere**, and **References**.

Publication searches are finicky by design. For instance, they are unforgiving with regard to misspellings. (The

Edward Dunne is the Executive Editor of Mathematical Reviews at the American Mathematical Society. His email address is egd@ams.org.

AMERICAN MATHEMATICAL SOCIETY
MATHSCINET®
MATHEMATICAL REVIEWS

ISSN 2167-5163

Publications | Authors | Journals | Citations

Search Terms

Author ▾	[ ]	and ▾
Title ▾	[ ]	and ▾
MR Number ▾	[ ]	and ▾
Anywhere ▾	[ ]	

Time Frame
● Entire Database
○ [= ▾] Year [   ]
○ Year Range: [   ] to [   ]

Publication Type
● All
○ Books
○ Journals
○ Proceedings

Review Format
○ PDF
● HTML

[Search] [Clear]

Facts and Figures: 3,671,591 total publications

Help | Contact Us

AMS AMERICAN MATHEMATICAL SOCIETY

Figure 1. Screenshot of the publication search page, with other search tabs identified.

searches do match regular plurals and singulars, but not irregular plurals.) However, you can use the wildcard (*) in most of the fields. The exceptions are **MR Number** and **DOI**, since these fields are searching for a very precise locator ID. A wildcard (*) can be used anywhere in a search term except the beginning. It will match any character string, i.e., one, two, three, or more characters, but also the empty string. Thus, **colo*ring** will match both **coloring** and **colouring**.

Words entered in any search field other than the author field are assumed to be separate terms, that is, separated by a Boolean AND. In other words, the default search is not for the phrase but for the individual terms. Consequently, a search for **hyperbolic manifolds** would look for items that have the word **hyperbolic** somewhere and the word **manifolds** somewhere but not necessarily right next to each other. So, you would find papers about **hyperbolic manifolds** but also a paper about **hyperbolic** equations on **manifolds**.

If you want to look for an exact phrase, you need to enclose the search phrase in double quotes. For example, a search for **"group cohomology"** anywhere will find more than 700 items where this exact phrase occurs somewhere in the item: in the title, in the review text, in the name of the journal. The words have to be in order. So, this search will not look for the phrase **cohomology group**. The search for **"cohomology group"** anywhere will match 3,000+ items with exactly that phrase. Note that the search

for **"cohomology group"** will not match items that only have the phrase **cohomology groups**, since plural/singular matching is turned off inside double quotes. To match both, use the wildcard search **"cohomology group*"**. This matches 7,000+ items.

It is possible to fine-tune a publication search by using a *proximity operator*. Specifically, you can allow some distance between terms in an exact search by enclosing the terms in double quotes, then appending the tilde (~) and a single-digit (positive) number. The number determines how many terms can be in between the search terms you have specified. For instance, if you want to search for papers discussing **harmonic functions**, including those that discuss **harmonic univalent functions**, use the search **"harmonic functions"**~1. You can include a wildcard too, as in **"harmonic function*"**~1. The number you provide is an upper bound. That is to say, the search **"integrable systems"**~2 will find results having two, one, or no terms in between **integrable** and **systems**, such as **integrable and superintegrable systems**, **integrable Hamiltonian systems**, and just **integrable systems**.

Here are descriptions of the possible fields:

Author: This field looks for papers, books, etc., where at least one of the authors matches the search term. (Note: if you want to search for an author, not just their publications, use the Author Search described in Part II of this article (in the October issue of *Notices*). Author searches lead to Author Profile pages, which contain a lot of information

about the author.) For the author field in a publication search, you need to enter the name as last name, first name, middle name(s) or initial(s)—with or without commas and periods. Searching for **Tate John** turns up about 100 results. Searching for **John Tate** turns up none. If you just enter one name, it is assumed to be a last name. Thus, if you search on **John**, you will receive almost 800 matches, all of which have an author with last name John, including more than 100 items by Fritz John. The results will also include one paper, MR0953284, by an author with first *and* last name John. The wild card (*) can be used anywhere within the string, except at the beginning. For instance, if you want to search for **Cheng**, **Chang**, **Chung**, or **Cheung** in the Author field, the search term **Ch*ng** will get the job done, though it will also match on **Ching** and **Channing**, for instance.

It is important to distinguish the **Author** search field from the next field.

Author or Related: Now, the search will include papers matching the author but also will include matches with other sorts of names associated with the document, for example, editors, translators, and contributors who are not listed as authors, such as someone who wrote an appendix or foreword to a book. For instance, a search for **Morawetz** in the **Author or Related** field and *Works* in the **Title** field would find volumes for which Cathleen Morawetz was an editor of someone else's Selected Works or Collected Works. **Author or Related** also includes names that represent the subject of the paper or book, such as when it is a biography, an obituary, a conference in honor of someone, or a Festschrift. For example, a search for Kodaira in the Author Related field would turn up articles about him but not necessarily about the Kodaira embedding theorem or Kodaira dimension. These extended affiliations with an item are what are listed under **Related Publications** in an Author Profile page on MathSciNet.

Title: This field contains the original title and, if appropriate, an English translation of the original title. It does not include subtitles. The same rules about word order and proximity operators apply here.

Review Text: You can search for keywords or phrases found in the text of reviews, including those where the author summary was used as the review. Again, the rules about word order and proximity operators apply here. So, for instance, if you are curious about wrong proofs, you could try searching for **Review Text = wrong proof**. But that will give you too many matches (more than 1,000) to be useful, and the words **wrong** and **proof** need not be close to each other. A better search is **Review Text = "wrong proof"~2**. This produces 57 matches, including

> MR3725869
> Dieks, Dennis (NL-UTRE-HQ)
> Von Neumann's impossibility proof: mathematics in the service of rhetoric.

Stud. Hist. Philos. Sci. B Stud. Hist. Philos. Modern Phys. **60** (2017), 136–148.

The review of this paper contains the passage:

> According to what has become a standard history of quantum mechanics, in 1932 von Neumann persuaded the physics community that hidden variables are impossible as a matter of principle, after which leading proponents of the Copenhagen interpretation put the situation to good use by arguing that the completeness of quantum mechanics was undeniable. This state of affairs lasted, so the story continues, until Bell in 1966 exposed von Neumann's **proof** as obviously **wrong**.

Journal: You can specify that the results must come from a particular journal. The journal field contains full and abbreviated journal names, as well as ISSNs. Original and translated journal names are searched. Note: this field can be particularly finicky, as it is trying to match against the exact name of the journal or the abbreviation of the journal name in MathSciNet or the ISSN. If you are unsure of the name or abbreviation, it is good to use wildcards in this field. You should put something in this field only if you are entering other information in another field, such as a subject class or a keyword. If you are looking for the journal itself, you should use the Journal Search, which is described in Part II of this column. A Journal Search leads you to the profile page of the particular journal and a wealth of information gathered from the MRDB.

Series: The Series field contains full series titles or abbreviations for book series. Book series include monograph series, such as Springer's *Grundlehren der Mathematischen Wissenschaften* and Cambridge University Press's *Cambridge Tracts in Mathematics*, as well as proceedings series, such as the AMS's *Contemporary Mathematics* and Springer's *Lecture Notes in Mathematics* and *Lecture Notes in Computer Science*. You can search on all or part of the series title.

Institution: You can enter either an institution code or part of the institution name in this field. Initially, institutions were created for internal use at Mathematical Reviews to help us to identify authors. Our catalogers include codes for institutions, which are a great shorthand. These codes show up as the strings in parentheses after the author's name when displaying the MathSciNet record for an item. Hovering over the code with the cursor will give you an expansion of the institution name. You can look up codes by going to `https://mathscinet.ams.org/instcode`. Alternatively, you can look for a paper by someone at the institution and crib the code from the MathSciNet listing for that paper. The institution codes provide a specificity that keywords do not. For instance, searching for **Oxford** in the **Institution** field produces more than 13,000 items with one or more authors from a department or college

at the University of Oxford in the UK (institution codes of the form 4-OX*). However, it also matches 28 items from authors at Oxford College of Emory University in Oxford, Georgia, in the United States (institution code 1-EMRY-OX), as well as a few items with authors from institutions in Taipei.

Institution codes are granular, identifying departments. For instance, the Department of Mathematics at Brown University has the institution code 1-BRN. The Division of Applied Mathematics has the institution code 1-BRN-A. Some authors from the Division of Applied Mathematics list their affiliation as Department of Applied Mathematics, which we have coded as 1-BRN-AM. Since MathSciNet is a database of the mathematical literature, we use the affiliation that is given on the paper, which can be different from the official name. As a result, when searching, it is often best to use wildcards, in particular, of the form "1-BRN-*". There are exceptions to the granularity, including some of the mathematics institutes, such as AIM and SAMSI, which don't have departments.

Using institution codes can facilitate some interesting searches that are not just about the literature. For instance, someone considering graduate school in algebraic geometry might want to check to see how many papers in algebraic geometry have come from a particular institution in recent years. Do this by entering the Institution Code or name of the university, set **MSC-Primary** to **14** (the class for algebraic geometry), and pick a relevant **Time Frame**, such as **>2013**, to ensure that you are seeing recent papers.

MSC Primary: This searches on the primary classification codes from the Mathematics Subject Classification (MSC) assigned to an item by the Mathematical Reviews editors. The Primary Classification is selected by the editors as being the most appropriate, among the possible classifications, for the principal contribution of the item. Every classified item has a primary classification. Many items have one or more secondary classifications. To search for primary or secondary classifications, use the **MSC Primary/Secondary** field. You can search using 2-digit (e.g., **35** for Partial differential equations), 3-digit (e.g., **35J** for Elliptic equations and systems), or 5-digit (e.g., **35J60** for Nonlinear elliptic equations) codes, with no need for wildcards.

Hack alert: The database includes more than 85,000 items that are PhD theses. These items use bibliographic data that have come from external sources, such as ProQuest and NumDam. To search for theses, enter **Thesis** in the **MSC Primary** field.

Reviewer: Entering a term in this field searches on the name of the person who wrote the review of the item, returning a list of those items. The syntax for entering names is the same as for the Author field. Not many people use this search, but it is useful in some special settings. For instance, it can be useful to editors considering referees.

References: MathSciNet includes reference lists from some articles. It is possible to search just within the reference lists by including search terms in this field. If you are looking for all the citations of a particular author, it is better to do an Author Search and use the citations link from there. When we match citations to an author, we match against all known variants of the author's name. Also, if you want to find all the citations of a particular paper, those are given in a box in the top right-hand area of the listing of that item. Again, our matching tries to account for variants of citation styles and will even try to match the published version of a paper with a citation to a version from the arXiv.

I find this search useful when looking for citations to books or papers that pre-date the MRDB, i.e., before 1940. For instance, I could look for Cauchy's "Recherches sur les nombres," which was published in the *Journal de l'École polytechnique* in 1813, by entering "Cauchy Recherches sur les nombres" in the **References** field. This search produces 103 matches, including

> MR2225493
> Bourgain, J.(1-IASP-SM); Glibichuk, A. A.(RS-MOSC-MM); Konyagin, S. V.(RS-MOSC-MM) Estimates for the number of sums and products and for exponential sums in fields of prime order. *J. London Math. Soc.* (2) **73** (2006), no. 2, 380–398.

If I check this item's entry in MathSciNet, I do indeed find Cauchy's paper as entry number 7 in the reference list for the article by Bourgain et al.

MR Number: All items in the MR Database have a unique seven-digit accession number of the form MR0053338 referred to as an **MR Number**. These numbers are searchable in the **MR Number** field. Leading zeros in this seven-digit number may be omitted. The "MR" prefix may also be omitted. For the example, searching on **53338** in this field will find the item just as well as searching on MR0053338. Wildcards do not work in this field—they are ignored.

DOI: You can search for an item by entering the DOI for the paper. You can include the DOI resolver, such as doi.org, or leave it out. You can include the full URL, such as **https://doi.org/10.1090/S0273-0979-1992-00266-5**, or just include the DOI itself, **10.1090/S0273-0979-1992-00266-5**. Wildcards do not work in this field.

Anywhere: This field is used to search across all of the fields already mentioned, except the reference lists.

Working with the Search Results

Sorting the results

The list of headlines of results from a publication search are sorted newest first by default. However, you can re-sort the results of a publication search by using the button after "Sort by:" in the top left of the screen. The options for sorting are: **Newest** first, **Oldest** first, number of **Citations**, and number of authors, abbreviated as **#Authors**.

Search within results

Typing a search term in this box will run an **Anywhere** search on that term among the results from your just executed search. You can do it from any page of results, and it will run the search from that point. Also, the proximity operator mentioned earlier works in the "Search within results" box, as do wildcards.

Filter using the facets

On the results pages from a publication search, there are six facets in the left-hand sidebar that you can use to refine your search: **Item Type**, **Institutions**, **Authors**, **Primary Classification**, **Journal**, and **Year**.

Item Type

- **Reviewed.** An item that has a review attached to it, either a signed review by one of our 21,000+ reviewers or the author summary.
- **Indexed.** An item that has received the full bibliographic treatment, including author authority work and MSC Classification, but that will not receive a review.
- **Expansion.** Also known as "Database Expansion," these items are not classified and do not have reviews. In every other respect they are treated just like all other items in the Mathematical Reviews Database. In particular, the authors are identified, and the items have journal linking and original item linking (when available).
- **Thesis.** These are doctoral theses whose bibliographic data have been contributed by an external source. Authors have been identified for about two thirds of the theses. We do not add classifications (MSCs) to theses.
- **DML** = Digital Mathematics Library. These items come from various digitization projects, such as de Gruyter's project that digitized all the early issues of Crelle's Journal, *Journal für die reine und angewandte Mathematik*.
- **Prelim.** These are Preliminary Data items, which we have created using the bibliographic metadata provided by the publisher. Our work on the item is not yet complete; for example, our author identification work may not have been done. The purpose is to get these items into the MRDB as quickly as possible but with the proviso that some of the bibliographic details may be corrected by our catalogers.
- **Pending.** These are regular items for which the bibliographic work has been done—i.e., they have passed the possible Preliminary Status—and a review is planned, but the review is not yet complete. The reasons for being incomplete include: we have not sent it to a reviewer yet; we have sent it to a reviewer, but have not received the review back yet; we have received the review back, but our editors are still checking it over.

Institution. Short forms of the institutions attached to the papers in the search results are listed in this facet. They are in decreasing order of frequency. Selecting an institution adds it to the search and refines the results. You can iterate this process, which is useful since many papers have authors from more than one institution.

Authors. The names of the authors of the items in the search results are listed in this facet in decreasing order of frequency. As with the Institution facet, you can iterate this process.

Primary Classification. Using this facet will refine the search using the primary MSC code attached to the paper. Since every regular item has a unique primary class, it is not possible to iterate this filter.

Journal. Mathematicians often think of someone's paper in a particular journal. This facet allows you to filter for papers appearing in a particular journal. You cannot iterate this filter, as each paper is normally published in a unique journal.

Year. This facet filters for the publication year (not the year it first appeared in MathSciNet). It is not possible to iterate this filter.

In the October issue of *Notices*, I will describe the Author Search and the Journal Search. There is less to say about the searches themselves, as they are more direct searches. However, I will have more to say about the Author Profile Pages, which are the endpoints of Author Searches, and the newly revised Journal Profile Pages, which are the endpoints of Journal Searches.

Edward Dunne

Credits

Author photo is courtesy of the author.