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OPEN ACCESS IN MATHEMATICS

CURRENT STATUS,
BENEFITS FOR RESEARCHERS,
AND HOPES FOR THE FUTURE

**Olaf Teschke · Fabian Müller · Nov 22, 2018**

CURRENT STATUS

HOPES FOR THE FUTURE

- Published corpus makes up about 120 million pages of mathematics, almost evenly distributed between books and articles
- Longevity of mathematics requires full-scale solutions
- Progress through different layers of digitization and formalization: Scans, PDF, MathML, Semantic layer, formalized mathematics
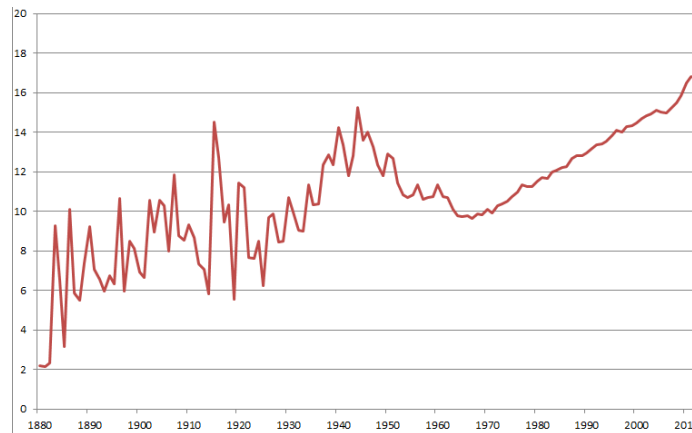
Average citation delays illustrate the longevity intrinsic to the corpus

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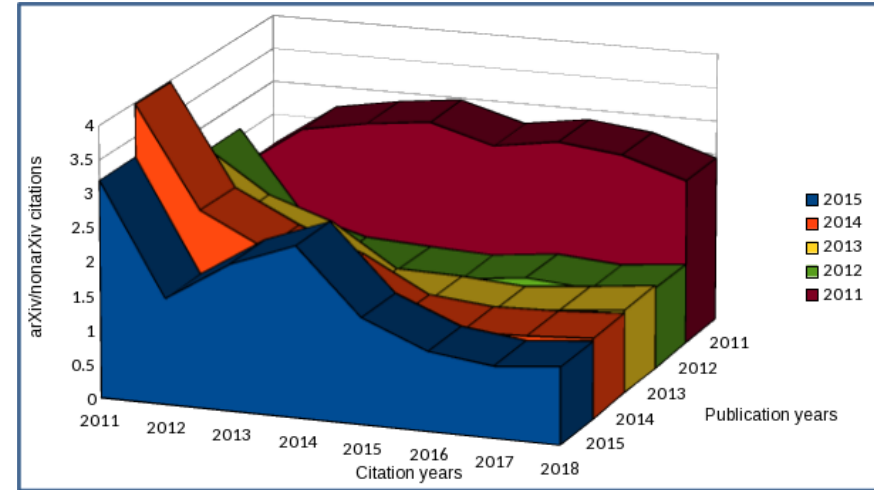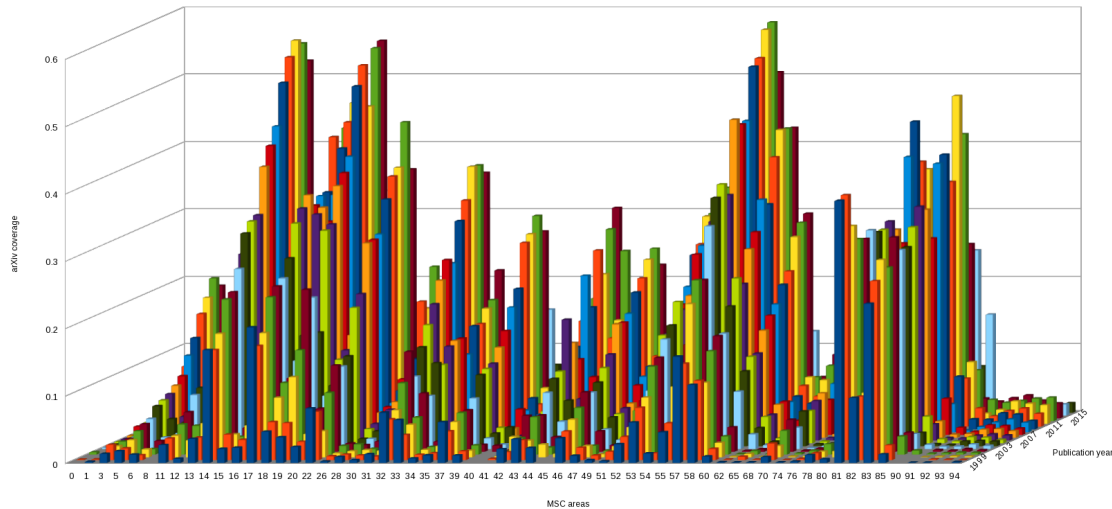
- Several math areas have achieved a high degree of arXiv coverage
- arXiv serves well with respect both to dissemination and preservation
- alignment desirable wrt to available versions and licenses

OA STATUS OF MATH JOURNALS

Category	non-APC OA			APC OA			Moving Wall (Eventually OA)			Subscription		
	Journal	Total#	Recent#	Journal	Total#	Recent#	Journal	Total#	Recent#	Journal	Total#	Recent#
FAST TRACK	13	9053	885	4	226	128	26	191721	16419	128	350425	28384
KAT 1	113	99279	13394	8	6786	922	36	116641	12386	336	512591	53734
KAT 2	201	73563	9316	39	21607	2513	23	39553	2878	435	545825	55961
KAT 3	114	14332	1785	52	10300	2359	2	1252	125	227	159908	17365
Under scrutiny[4]	85	20719	1370	31	7011	7720	1	2440	194	86	87452	6295

- APCs not accepted within mathematics
- Moving wall works well and should be extended
- Isolated quality platinum OA far from being sufficient
- Special need for funding the transition of society publishers to platinum models

Open Access in Mathematics

Various levels of digititation have been achieved:
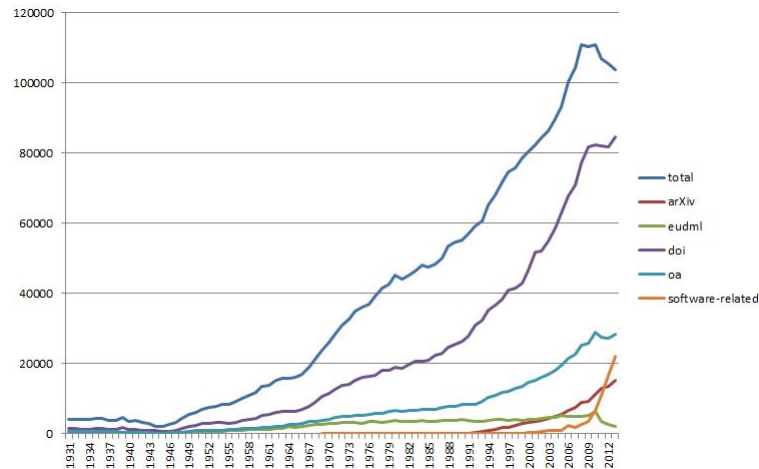
- Scan/pdf ($\sim$ 80% of documents, $\sim$ 60% of pages)
- Open available pdf ($\sim 20\%$ of documents, $\sim 10\%$ of pages)
- Open available LaTeX, XML, MathML ready for content analysis, formula processing ... ($\sim 5\%$ of documents, $\sim 2.5\%$ of pages)
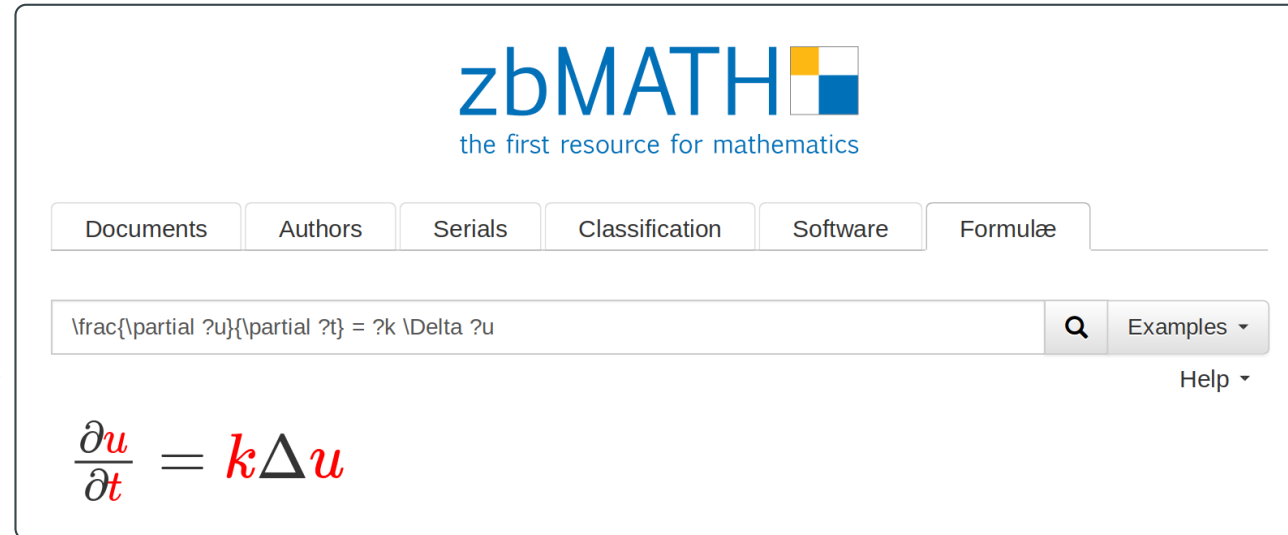
CURRENT STATUS
HOPES FOR THE FUTURE

OPEN ACCESS FOR BETTER FINDABILITY

Success example

- Users can search for formulae in zbMATH
  - LaTeX input
  - including search variables
  - 52 mio. formulae indexed from abstracts/reviews
- arXiv papers have LaTeX sources available for free
  - at least for preprint version
  - can index arXiv papers in zbMATH formula search
  - 161 mio. formulae indexed in total
  - find 72% more papers

zbMATH
the first resource for mathematics

| Documents | Authors | Serials | Classification | Software | Formulæ |

`\frac{\partial ?u}{\partial ?t} = ?k \Delta ?u`

Examples ▾

Help ▾

$$\frac{\partial u}{\partial t} = k \Delta u$$

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WHAT ELSE IS POSSIBLE?

Find similar equations

- by name
- by similarity

What is "similar"?

- basic mathematics
  - $a = b + c \longleftrightarrow a - b = c$ (**doable**)
- take semantic information from surrounding text into account
  - $ab \longleftrightarrow ba$ (**if** a and b are taken from a commutative domain)
  - $a^2 + b^2 \longleftrightarrow c^2$ (**if** the text specifies that (a, b, c) is a Pythagorean triple)
  - hard, but not impossible
- incorporate mathematical knowledge
  - $\nabla \cdot E = \frac{\rho}{\varepsilon_0} \longleftrightarrow \oiint_{\partial\Omega} E \cdot dS = \frac{1}{\varepsilon_0} \iiint_\Omega \rho dV$ (essentially needs Stokes' theorem)
  - connection to formalized mathematics (e. g. Mizar)
  - not yet feasible (but not impossible)

Open Access in Mathematics

A PIPE DREAM

- turn supplementary data into first-class objects
  - mathematical models
  - simulations
  - software packages
  - ...
- interlink
- semantify

  $\Longrightarrow$ **Open Access needed!**

time : 107.600
frame : 76

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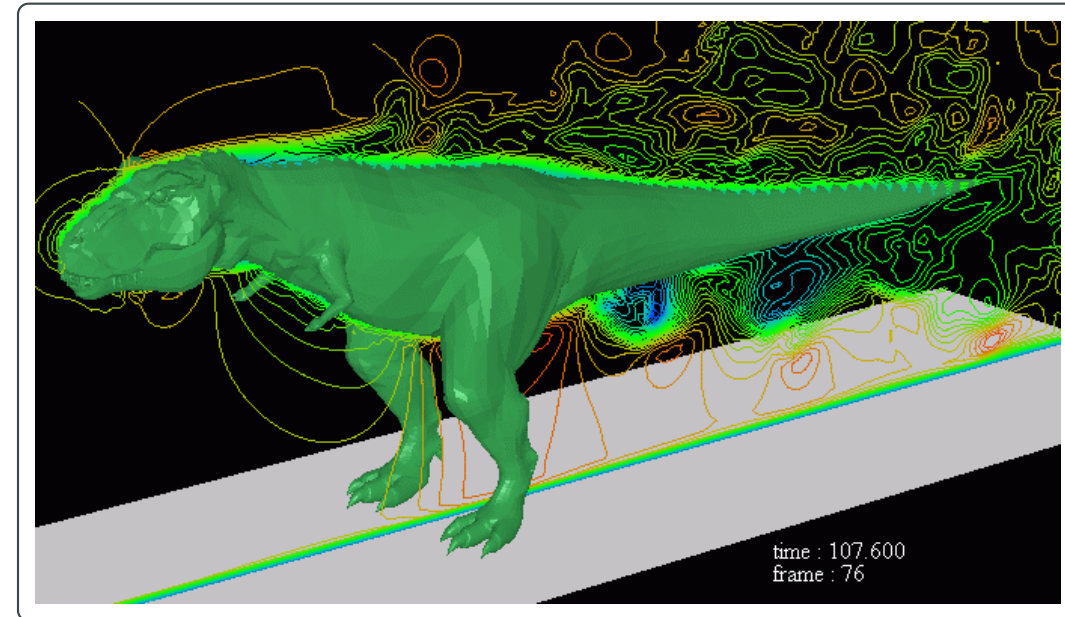
WHAT'S IN IT FOR ME?

- papers with **less boilerplate**
  - $\Longrightarrow$ just link to model ID
- better **findability**
  - $\Longrightarrow$ in both directions
- more **citations**
- better **attributability** of non-paper work
  - $\Longrightarrow$ e. g., writing a software package
- improved **reproducibility**
  - $\Longrightarrow$ save simulation parameters and results

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THANK YOU!
QUESTIONS?

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audit berufundfamilie

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Association