CEIC Quadrennial Report

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1 Introduction

1.1 CEIC Membership

Thierry Bouche UFR de Mathématiques, Institut Fourier, Université de Grenoble I, Grenoble, France (2011-2018)

Olga Caprotti Formerly Department of Computer Science and Engineering, Chalmers and University of Gothenburg, Sweden (2008-2016)

Tim Cole Grainger Engineering Library Information Center, University of Illinois at Urbana-Champaign, USA (2013-2020)

Ingrid Daubechies Department of Mathematics, Duke University, USA (2015–2018; EC liaison)

James Davenport Departments of Computer Science and Mathematical Sciences, University of Bath, UK (2008-2018; Chair 2015–2018)

Carol Hutchins Courant Institute, New York University, USA (2008-2016)

Patrick Ion Mathematical Reviews (Emeritus), Ann Arbor, USA (2015-2018)

Alf Onshuus Universidad de los Andes, Colombia (2017–2020)

Victoria Stodden University of Illinois at Urbana-Champaign, USA (2015–2018)

Masukazu Suzuki Kyushu University, Japan (2015–2018)

Ravi Vakil Department of Mathematics, Stanford University, USA (2011–2018)

The following members left at the end of 2014:

László Lovász Department of Computer Science, Eötvös Loránd University, Budapest, Hungary (2011-2014)

Peter Olver School of Mathematics, University of Minnesota, Minneapolis, USA (Chair) (2008-2014)

1.2 CEIC Meetings

2015 IMU Headquarters, Berlin; 21–22 March.

2016 University of Illinois, Chicago; 20–21 February.

2017 Mathematical Reviews, Ann Arbor; 18–19 March.

2018 Vrije Universitaet, Brussels; 26–27 May.

1.3 CEIC Remit

CEIC's charge, as a Committee of IMU is the following.

1. To advise the IMU on aspects of its operations related to information and communication, including technical, legal and financial implications, and keep it informed of new developments.

2. To review the development of electronic information, communication, publication, instruction, and archiving so as to keep the IMU abreast of current and emerging issues.

3. To advise the IMU about potential opportunities to endorse standards and articulate best practice recommendations on issues related to the field, as well as potential opportunities to foster the growth and development of electronic infrastructure.

In clauses 2 and 3, CEIC has interpreted "IMU" as representing the wider mathematical community, including IMU and its Adhering Organisations, as well as individual mathematicians world-wide. In particular, CEIC attempts to be sensitive to, and to raise consciousness about, the particular challenges of mathematicians in developing countries when it comes to electronic information and communication, collaborating in this respect with IMU's Commission on Developing Countries.

2 IMU operations

2.1 IMUnet

CEIC has contributed articles to most IMUnet issues. These have been largely about the set of negotiations ongoing, especially in Europe, between (national consortia of) universities and the major publishers. We have also tracked developments with GDML, and signalled to the community the changes in availability of MathJax, one of the fundamental tools for communicating mathematics on the web. We also drew the attention of the community to Giroux's plea [Gir11].

2.2 Archiving

After a burst of activity and development of procedures, the state fo archiving of electronic material and archives at IMU headquarters now seems stable, and the IMU Archivist is to be congratulated on her work. But there are permanent worries over the continued readability (both of the bits in the case of some material, and CEIC needs to continue to watch developments here, and of the semantics: are old spreadsheets etc. still readable?) of the archives.

2.3 ICSU WDS

IMU is a member of ICSU, the International Council of Science Unions, which is in the throes of merging with the International Social Science Council (ISSC) to become the International Science Council (ISC). One of ICSU's activities is the World Data System (WDS). IMU is an associate member of WDS, and CEIC handles this membership. While mathematicians do not generate the sort of experimental data that, say, geophysicists, do, there are nevertheless computational data, and to some extent questions of reproducibility. These mathematical data are intrinsically bound up with the software that produces or analyses them [DGJ18]. For some mathematicians, production of such software is a major activity, often under-recognised by formal reward processes, hence CEIC is tracking, and encouraging, software citation activities such as FORCE11 [SKN16].

2.4 IMU and DOIs

Currently individual ICMs produce their proceedings, and arrange publication and Digital Object Identifiers (DOIs) through a publisher. IMU's other publications (including CEIC's documents) do not have DOIs. CEIC has been investigating whether IMU should assign DOIs, either directly, via the Weierstrass Institute, or through some other deal.

3 Keeping abreast

3.1 Overlay Journals/Epijournals/arXiv

These have relatively recently received a substantial boost. In this development in publishing, journals, rather than hosting the scientific papers themselves, use services such as `arxiv.org`. We have discussed this with Mathematical Reviews, zbMath and `arXiv.org`, and these discussions will feed into our revisions of Best Practices. Related to this is the fact that an arXiv link such as `http://arxiv.org/abs/1304.1928` is a reference to a changeable document (unlike `http://arxiv.org/abs/1304.1928v2`), and documents on `arXiv.org` may be substially different from the final versions published elsewhere [RS13, RS15, compare equations (1)]. This too will feed into Best Practices.

3.2 Open Access

IMU has supported Open Access since 2001: see `http://www.mathunion.org/fileadmin/CEIC/Publications/Call_to_All_Mathematicians_to_Make_Publications_Electronically_Available.pdf` and IMU's membership of ICSU and its document `https://www.icsu.org/publications/open-access-to-scientific-data-and-literature-and-the-assessment-of-research-by-metrics`.

3.3 Access to Mathematics

The visually impaired have great difficulties accessing conventionally published mathematics. In general, electronic media *could* be easier to access, but this is often not the case. Many such mathematicians prefer to access the LaTeX source of papers, rather than PDF documents, but these are often not available, despite Giroux's plea. Again these discussions will feed into our revisions of Best Practices.

3.4 Metrics and Assessment

CEIC and IMU continue to believe in the untrustworthiness of metrics, as described in the San Francisco Declaration [San12] and, from the point of view of potential users, in [Hig15].

But this leads to *extremely* bad use of metrics, either by individual institutions or by countries that cannot afford the effort of full peer review, often raw paper counts independent of subject, and CEIC has been asked to develop some guidance in this area.

4 Global Digital Mathematics Library

This period has seen steady, if unspectacular, progress.

4.1 Background

On August 17, 2014, in conjunction with the International Congress of Mathematicians in Seoul, South Korea, the IMU and CEIC hosted a meeting of a select group of 21 experts plus at least eight remote participants to plan the next practical steps towards the construction of the Global Digital Mathematical Library (GDML). As a result, a smaller eight-person working group (WG) under the sponsorship of the IMU, was created. The WG members are Patrick Ion (who later also joined CEIC), chair (USA), Thierry Bouche (France), Bruno Buchberger (Austria), Michael Kohlhase (Germany), Jim Pitman (USA), Olaf Teschke (Germany), Stephen Watt (Canada), and Eric Weisstein (USA). The WG was charged with the tasks of designing a road map for the practical next steps towards the GDML, determining its organizational structure, prioritizing the different requirements for its implementation, estimating an incremental

budget, both start-up and sustaining funds, and fostering the writing of proposals to funding organizations.

4.2 2015

The WG held 40 minuted teleconferences in 2015 (12 in 2014) and also practiced outreach (community building) by presenting at the Spring CNI briefing and at OPSFA13 at NIST (Patrick Ion) and CICM in DC (Jim Pitman - plenary), while holding a F2F in DC in association with CICM. Questions of appropriate governance for this activity, which took up a lot of 2015, were resolved, and plans developed for creation of an International Mathematical Knowledge Trust, as an overall governing body. In addition, the WG spent time in 2015 organising sessions at the start of 2016 mentioned below.

4.3 2016

The WG held 30 minuted teleconferences in 2016. The WG organised 3 sessions (9 total hours) on "Mathematical Information in the Digital Age of Science" at the January 2016 Joint Mathematics Meeting in Seattle.

There also took place the Semantic Representation of Mathematical Knowledge Workshop at the Fields Institute. This was jointly organized with Wolfram Research and funded with $75,000 from the Alfred P. Sloan Foundation, February 3 - 5, 2016 in Toronto: see `http://www.fields.utoronto.ca/activities/15-16/semantic` and `http://www.wolframfoundation.org/programs/SemanticWorkshopWhitePaper.pdf`. It involved 37 participants.

In addition, information sessions and papers were organised at in Berlin at ICMS 2016 (Ion and Teschke) and ECM 2016 (Bouche, Ion and Teschke)and at CICM 2016 in Białystok (Ion). Since Bouche and Teschke are both involved with the European Digital Mathematics Library (EuDML), Ion made a presentation to the EuDML steering committee in Berlin following the ECM. The main activity of the WG was organising funding to establish the International Mathematical Knowledge Foundation (IMKT). It was decided that this should be a charity located in Canada (but with the opportunity to have subsidiaries elsewhere to benefit from different jurisdictions charitable foundation arrangements). An application, with numerous letters of support, was submitted to the Alfred P. Sloan Foundation and $125,000 was granted at the very end of 2016, with PIs Ingrid Daubechies (Duke) and Stephen Watt (Waterloo).

4.4 2017

The GDML WG held a further 27 minuted teleconferences in 2017, still using bridge facilities provided by Wolfram research. The WG's main accomplishment has perhaps been not giving up, as previous attempts have done, since matters move much more slowly than expected, and certainly than widely hoped. The charity IMKT is well-founded after lengthy legal consultations and now has 8 directors on its board: Jennifer Chayes (Microsoft Research), Ingrid Daubechies

(Duke U), Patrick Ion (GDML WG), Ursula Martin (Oxford U, UK), Scott Pagan (Descartes Systems Group Inc.), Bernard Saint-Donat (Saint-Donat & Co.), Stephen Watt (U Waterloo), Glen Whitney (ex-Renaissance Technologies and MoMath).

GDML outreach in 2107 held sessions in July at a Big Proofs Workshop in Oxford (Stephen Watt and PI), and CICM 2017 (PI) in Edinburgh UK; see `https://digitalmathlibrary.org/activities-2/`. Of four initiatives IMKT sets itself to encourage, one on Formal Abstracts has been realized as a project led by Tom Hales (U Pittsburgh) and Jeremy Avigad (Carnegie-Mellon U), that has been funded for 3 years by the Alfred P. Sloan Foundation, as a cooperation with a team in Hanoi; see `https://github.com/formalabstracts/formalabstracts`. A Special Functions Concordance initiative has seen progress in activity at Wolfram Research and NIST, but is no project yet, although some informal meetings were held, and relevant papers written. In addition, IMKT has contact with two other projects involving use of machine learning in analyzing the mathematical literature.

4.5 2018

A reprise of the successful 2016 sessions was organized and run at the January 2018 Joint Mathematics Meeting in San Diego; see `http://mathontheweb.org/gdml/JMM2018/SS83-slides/`. This continued, in particular, contacts with the European Digital Mathematics Library and the arXiv, with whom collaboration is sought. A suitable IMKT website, http://imkt.org/, has proved surprisingly difficult to create but should be in place by ICM 2018.

A Panel on GDML issues has been organized for ICM 2018, and will feature Thierry Bouche (France), Gadadhar Misra (India), Alf A. Onshuus (Colombia), Stephen M. Watt (Canada) and Liu Zheng (China) with Patrick Ion as moderator.

5 Best Practices

The following are IMU/CEIC publications that undergo revision as is found necessary:

- Copyright Recommendations (2001; undergoing revision)
- ICM Panel on Mathematical MOOCs (2014)
- IMU/CEIC Blog on Mathematical Journals (2012; historical but still valid)
- Best Current Practices for Journals (2010; being updated)
- Some Best Practices for Retrodigitization (2006; still valid but not scheduled for update)
- Digital Mathematics Library: A Vision for the Future (2006; historical)

- Recommendations on Information and Communication (2002)
- Call to All Mathematicians to Make Publications Electronically Available (2001)

References

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[RS13] M. Rötteler and R. Steinwandt. A note on quantum related-key attacks. `https://arxiv.org/abs/1306.2301`, 2013.

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