

7 June 2019

ANZSRC Review Steering Committee
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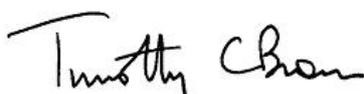
Dear members of the ANZSRC Review Steering Committee ,

**[SUBMISSION TO THE REVIEW INTO THE AUSTRALIAN AND NEW ZEALAND STANDARD
RESEARCH CLASSIFICATION]**

The Australian Mathematical Sciences Institute (AMSI), the Australian Mathematical Society (AustMS) and the Statistical Society of Australia (SSA) welcome the opportunity to make a submission to this review of the ANZSRC Research Classifications.

As the lead organisations representing the disciplines of mathematics and statistics in Australia, we are well placed to make comment and provide advice pertaining to mathematical sciences research and its applications. The following observations and recommendations are the result of consultation with academic research staff in the mathematical sciences, aligned with SSA, AMSI and AustMS - including its Divisions ANZIAM (Australian and New Zealand Industrial and Applied Mathematics) and ANZAMP (Australian and New Zealand Association of Mathematical Physics).

Yours sincerely,



Professor Tim Brown
AMSI Director



Professor Jacquie Ramagge
AustMS President

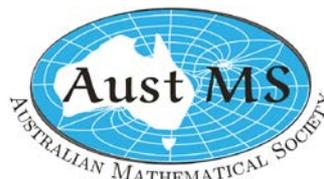


Professor Adrian Barnett
SSA President

Review ANZSRC Research Classifications

Joint submission by AMSI, AustMS,
and SSA

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ANZSRC Principles

1. Are the principles of the Review outlined in Section 2 of the Discussion Paper appropriate and sufficient? Do any further overarching principles need to be considered in developing the revised ANZSRC?

Research area identifiers such as FoR codes are useful to guide processes such as review of research grant proposals, as well as to report on research activity in the wider economy. It is important however to acknowledge and accept that no system of classification is ever perfect, and that every use of such a system is subject to interpretation. A certain measure of ambiguity is unavoidable, and can only be minimized but never eliminated.

ANZSRC Classifications

Fields of Research

6. Is the current overall structure appropriate?

In the consultation process, the appropriateness of the overall structure of the classification for the mathematical sciences has been subject to some critical comments:

1. The current FoR codes are biased towards past and existing research strengths in Australian mathematics and statistics, and do not always align well with internationally important areas. It would be good to continuously monitor the system, to emphasize the traditional Australian strengths and at the same time accurately classify the research of recently hired international researchers.
2. The current classification divides along pure/applied/statistics and so forth, rather than along research areas (such as for instance the internationally recognised [American Mathematical Society's classification for mathematical research](#)). This means that some researchers tend to publish under different codes: for instance, many applied mathematics researchers publish under 0101 (Pure Mathematics) or 0105 (Mathematical Physics) as well as outside 01 (Mathematical Sciences).

Given these remarks, the overall structure is still regarded as adequate to the task.

7. What criteria, in your view, should be applied to determine the classification of research?

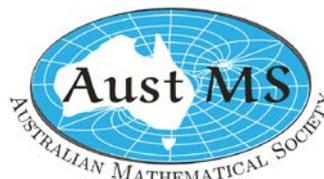
b. Should research methodologies, publication practices, or any other factors be considered as key criteria for classifying research?

Research should not be classified under 0104 purely on the grounds of the use of statistical methods, but primarily on the development of new probabilistic or statistical methodology. As well, other criteria such as the purpose of research, publication journals, citations and other factors should not be considered as key criteria for classifying research.

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8. Where should the classifications change (at the Division, Group or Field level)?

a. What new or emerging areas of research should be allocated FoR codes (and at which level)?

These are some general comments on the inclusion of new and emerging areas:

1. New areas of research can span more than one discipline – for the development of a distinctive profile, a separate code is preferable. A case in point is biological mathematics: the skill set required is morphing from traditional applied mathematics to now including a fair amount of computational statistics, but mostly using those statistical methods, which might not qualify as statistical research. It therefore makes sense to keep the specific classification 010202 for Biological Mathematics.
2. It would be a good idea for the ARC to periodically perform content (text-mining) analysis of various international research databases (e.g. Google Scholar, Web of Science) to investigate whether new Australian research clusters appear – which could be a sign of newly emerging research areas in Australia.
3. For consideration also is that a separate six-digit code (Emerging fields in Mathematical Sciences, see below) is included under 0199 (Other Mathematical Sciences) to capture emerging research as separate from research that cannot be classified elsewhere.

Inclusion of Data Science

Given the increasing importance of data science research in the mathematical sciences, the area of **Data Science** and/or **Large and Complex Data** should be included in the FoR structure. Consultation revealed that the preferred option is *inclusion at the six-digit level under 0104 (Statistics)*. Under statistics, data science could be covered by 2 distinct six-digit codes: (Statistical) Data Science, and Large and Complex data. What this would accomplish is ensuring that data science as a discipline has a distinct home under mathematical sciences, not just under 08 (computer science). In terms of visibility it would remain a strictly statistical code - which means any applied mathematics in this area would have to be coded to 0104.

b-c-d-e. Proposed changes to the existing FoR codes in 01

At the four-digit group level:

After consultation, there is no evidence that any of the current Groups 0101 (Pure Mathematics), 0102 (Applied Mathematics), 0103 (Numerical and Computational Mathematics), 0104 (Statistics), 0105 (Mathematical Physics) and 0199 (Other Mathematical Sciences) are no longer useful so no change is proposed.

At the six-digit field level:

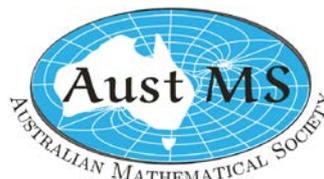
0101 – Pure Mathematics

No changes proposed.

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0102 - Applied Mathematics

The following changes (in red) are proposed:

010201 Approximation Theory and Asymptotic Methods

010202 Biological Mathematics

010203 Calculus of Variations, Mathematical Aspects of Systems Theory and Control Theory
– changed **wording***

010204 Dynamical Systems in Applications

010205 Financial Mathematics

010206 Operations Research

010207 Theoretical and Applied Mechanics

010299 Applied Mathematics not elsewhere classified

0102XX Mathematical methods/special functions- new (010201 does not really cover this);

0102XX Dynamical Systems and Ergodic Theory -new (currently only covered by 010109)

*010203 – Rationale for change: Applications of control theory to engineering are included in Groups 0906 *Electrical and Electronic Engineering* and 0913 *Mechanical Engineering*, however this does not prevent engineering papers from *Systems Theory and Control Theory* to be classified as Applied Mathematics. Changing the wording would clarify the mathematical emphasis of this code.

0103 – Numerical and Computational Mathematics

The following changes (in red) are proposed:

010301 Numerical Analysis

010302 Numerical Solution of Differential and Integral Equations

010303 Optimisation

0103XX Experimental mathematics - new (close to other computational maths, other term for symbolic computation)

010399 Numerical and Computational Mathematics not elsewhere classified

0104 – Statistics

The following changes (in red) are proposed:

010401 Applied Statistics

010402 Biostatistics

010403 Forensic Statistics -removal recommended*

010404 Probability Theory

010405 Statistical Theory

010406 Stochastic Analysis and Modelling

010499 Statistics not elsewhere classified

0104XX Computational Statistics – new**

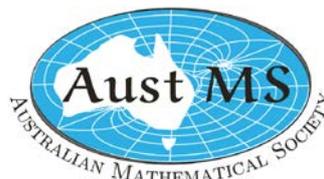
0104XX (Statistical) Data Science - new (see discussion above)

0104XX Large and Complex Data - new (see discussion above)

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*010403 -Rationale for removal: insufficient use. However, if ARC prefers inclusion of a code to reflect this area more broadly, this six-digit code should be renamed to encompass other mathematical research in genomics or genetics.

**The rationale for adding Computational Statistics is that research on resampling methods, Monte Carlo methods, and artificial neural networks have been vigorously developed in past decades in Statistics. These are computationally intensive statistical methods suitable to be allocated in Statistics.

0105 - Mathematical Physics

No changes proposed.

0199- Other Mathematical Sciences

The following changes (in red) are proposed:

019999 Mathematical Sciences not elsewhere classified

0199XX Emerging fields in Mathematical Sciences (for consideration, see discussion above)

10. How can the FoR codes better capture interdisciplinary/multidisciplinary research, and at what level (e.g. Field, Group, Division)?

Interdisciplinary and multidisciplinary research need to remain as activities that can be classified under multiple FoR codes.

Implementation

16. How do you (or your organisation) currently use ANZSRC?

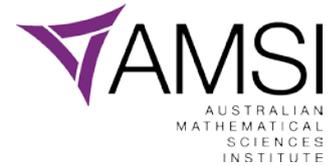
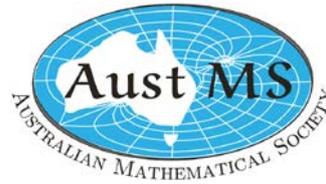
For the mathematical sciences, the FoR classifications are used in the assessment of research proposals under the ARC NCGP scheme, and in the assessment of research under the ERA. Given the fact that there is always some ambiguity and room for interpretation in applying classifications to existing research, there are a few issues that can be identified around how the FOR classifications are used and implemented:

1. As a general comment, the use of research classifications to assess research in the different classified areas is far from optimal if the assessment is limited to using bibliometrics. Bibliometrics should ideally never be used as a single measure to assess research and should always take into account the often large variation in citation practices between fields of research. As far as the Mathematical Sciences are concerned, we reiterate that bibliometrics are inappropriate for 0101 (Pure Mathematics), where peer review is a necessity.

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2. It is noted that the research classifications are used strategically in the ERA in a way that can potentially disadvantage some research areas. This does not affect the usefulness of FoR codes in the academic sense either way, however does open the question of monitoring and restricting the use of classifications for strategic purposes, in particular in ERA, in other ways than intended.