Research Support Office

Radioactive Waste Management

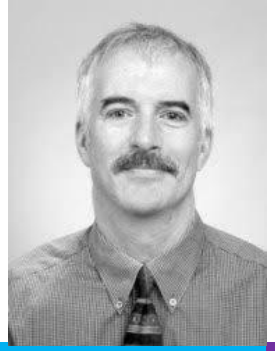
RSO Discipline Update: Applied Mathematics

Discipline Lead: Robert Zimmerman (Imperial College)

Subject Matter Expert: Mike Poole (RWM) and Oliver Hall (RWM)

RWM-RSO Annual Conference
Hyatt Regency Manchester
15-16 September 2021

Discipline Lead



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Robert Zimmerman Professor of Rock Mechanics at Imperial College London, was appointed as Discipline Lead for Applied Mathematics in January 2021.

Editor-in-Chief of the *International Journal of Rock Mechanics and Mining Sciences*, and co-author of the definitive monograph *Fundamentals of Rock Mechanics*, 4th ed. (Wiley-Blackwell, 2007).

Ten years of experience as a researcher and PI on the US DOE's Yucca Mountain nuclear waste repository project, was PI on the €3M Euratom THERESA project, PI on the £2.5M NERC-RWM-EA-funded Hydroframe project, has been a PI on two rounds of the DECOVALEX project, an international collaboration on the development of computational codes for simulating processes relevant to Geological Disposal Facilities, and is currently working with SKB on rock spalling in the Swedish GDF in in Forsmark.

Subject Matter Expert

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Mike Poole is Senior Modelling Manager at RWM. He has over twenty-five years of research and modelling experience.

His background is physics, and his role focuses on assessment of the post-closure safety of a geological disposal facility, developing understanding and mathematical models of the many processes on which long-term safety may depend.

Mike is RWM lead on mathematical modelling, and the treatment of uncertainty. His particular interests include probabilistic modelling, including developing total-system-level models of complex systems to address high levels of uncertainty, and quantification of uncertainty by expert judgment, in which field he has published a number of internationally peer-reviewed papers.

Subject Matter Expert

Research Support Office

Oliver Hall is a Post-closure Safety Specialist at RWM. His background is in Theoretical & Computational Physics, with a PhD from Durham in 2014.

His interests are in demonstrating the long-term safety of a GDF, through assessments of system performance, as well as more general mathematical and computational modelling.

Since joining RWM in 2016, Oliver has been responsible for the development of RWM's Digital Safety Case management system, ViSI. He was the original developer of the system, and now manages its technical development with a commercial supplier. He is at the forefront of RWM's efforts to create a truly accessible and traceable Environmental Safety Case (ESC), by linking the safety case directly to its evidence base, using ViSI.

Background

Prior to the formation of the RSO, RWM had a four-year contract with the Smith Institute for the supply of advice relating to applied mathematics.

This work included a detailed review of mathematical modelling within RWM, and the development of methodologies for uncertainty quantification, and for decision-making under uncertainty for site characterisation.

RWM do not expect there to be further direct research needs in this discipline, prior to site-specific work. Consequently, we expect that initially the applied mathematics discipline in the RSO will support projects in other disciplines that have a high reliance on mathematical modelling.

Activities in 2021

- Two meetings between DL (Robert Zimmerman) and SME (Mike Poole)
- Four Programme Executive Board and other RWM-RSO Meetings
- Three technical meetings to discuss potential projects related to bentonite and low-strength sedimentary rocks
- The Applied Maths team has provided technical input to several PhD bursary projects

Upcoming opportunities

The following PhD projects will be included in the upcoming RWM-RSO bursary call, which is planned to be sent out in October:

1. Fracturing of mudstone interbeds due to halite creep, and implications for the performance of a geological disposal facility for radioactive waste (Matthew Kirby, Kevin Taylor, Robert Zimmerman, and Sam Shaw)

2. Developing fundamental understanding of Thermo-Hydro-Mechanical-Chemical coupled processes in compacted bentonite (Matthew Kirby, Claire Corkhill, Robert Zimmerman, and Sam Shaw)

“Applied Mathematics” is also one of the component themes of the Low Strength Sedimentary Rock (LSSR) Topic Area, as discussed yesterday