Dear Researchers & MSc students,

Chemical Engineering School of The University of Adelaide opens three PhD positions in the area of transport phenomena in porous media. The industrial and environmental applications include CO2 and hydrogen storage, contamination of aquifers, well stimulation, and Enhanced Oil Recovery. However, the *focus of the work is on applied mathematics*. The activities include *exact and asymptotic solutions of non-linear partial differential equations*.

MSc in applied or pure mathematics, or in theoretical physics, is required. Publications would be a bonus for a candidate. The exceptional cases of MSc in mechanical, environmental, civil, petroleum, or chemical engineering with high mathematical background will be considered.

Please send your CV in English with the list of publications to pavel.bedrikovetski@adelaide.edu.au. To see the recent publications of our group, please look into Bedrikovetsky in Google Scholar. The deadline for application is 01/11/2024.

Sincerely
Pavel

Stable Unique Riemann Solution For 2x2 Hyperbolic System

Multiple discontinuous solutions of conservation law systems is a well-known phenomenon. Selection of unique solution has been performed by either stability criteria or asymptotic vanishing dissipation method. Recently developed splitting mapping and the asymptotic method of matched singular first-order expansions allow deriving unique solutions of several Riemann problems. One of those relates to in situ storage of CO2 and hydrogen in geological formations, which is a top priority in Australian energy sector.

The scope comprises derivation of unique Riemann solution for 2x2 hyperbolic system stable with respect to vanishing diffusion and capillary pressure. The topological aspect included description of the phenomenon in terms of classification of singular points of smooth manifolds. The industrial application includes using the Riemann solution in 3D commercial stream-line reservoir simulator.

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Bedrikovetsky, P., 2013. Mathematical theory of oil and gas recovery. Springer Science & Business Media. 600 p.

Borazjani, S., Roberts, A.J. and Bedrikovetsky, P., 2016. Splitting in systems of PDEs for two-phase multicomponent flow in porous media. Applied Mathematics Letters, 53, pp.25-32.

Borazjani, S. and Bedrikovetsky, P., 2017. Exact solutions for two-phase colloidal-suspension transport in porous media. Applied mathematical modelling, 44, pp.296-320.

Nazaikinskii, V.E., Bedrikovetsky, P.G., Kuzmina, L.I. and Osipov, Y.V., 2020. Exact Solution for Deep Bed Filtration with Finite Blocking Time. SIAM Journal on Applied Mathematics, 80(5), pp.2120-2143.

Russell, T. and Bedrikovetsky, P., 2024. Exact solution for water evaporation during CO2 injection. Water Resources Research, 60(6), p.e2023WR036600.