The Journal of Open Source Software

FEniCS-SZ: two-dimensional modeling of the thermal structure of subduction zones

Cian R. Wilson [1*¶], **Cameron Seebeck**[1*], **Kidus Teshome**[1*], **Nathan Sime** [1*], **and Peter E. van Keken** [1*]

1 Earth and Planets Laboratory, Carnegie Institution for Science, Washington D.C., United States ¶ Corresponding author * These authors contributed equally.

DOI: 10.xxxxxx/draft

Software

- Review
- Repository
- Archive

Editor: Open Journals

Reviewers:

- @openjournals

Submitted: 01 January 1970
Published: unpublished

Summary

Plate tectonics ... subduction zones ... volcanoes, earthquakes,.... metamorphism .... temperature control (van Keken & Wilson, 2023)

Statement of need

FEniCS-SZ is cool and is based on Wilson & van Keken (2023).

FEniCS-SZ is intended also for classroom use and interactive work via a Jupyter notebooks (Wilson et al., 2025) that explore the FEM examples in Wilson & van Keken (2023). The didactic nature of these tutorials (progressing from the stand-alone Poisson and Stokes equations, reproduction of mantle convection benchmarks, to the fully coupledset of time-dependent equations used in the subduction models) augments the FEniCSX Tutorial (Dokken, 2023), which is itself built on the FEniCS Tutorial (Langtangen & Logg, 2016).:

State of the field

Software design

Research impact statement

AI usage disclosure

No information or code was harmed by AI.

Acknowledgements

We acknowledge support from the National Science Foundation (NSF) grants (EAR-1850634 and EAR-202102) and the Carnegie Institution for Science through its summer intern program sponsored in part by NSF XXXX.

References

Dokken, J. S. (2023). *The FEniCSx Tutorial*. https://jsdokken.com/dolfinx-tutorial/

Langtangen, H. P., & Logg, A. (2016). *Solving PDEs in Python* (p. 146). Springer Open. https://doi.org/10.1007/978-3-319-52462-7

van Keken, P. E., & Wilson, C. R. (2023). An introductory review of the thermal structure of subduction zones: I—motivation and selected examples. *Progress in Earth and Planetary Science*, *10*(1), 42.

Wilson, C. R., Seebeck, C., Teshome, K., Sime, N., & van Keken, P. E. (2025). *The FEniCS Subduction Zone Jupyter Book*. https://github.com/cianwilson/fenics-sz/blob/main/readme.md

Wilson, C. R., & van Keken, P. E. (2023). An introductory review of the thermal structure of subduction zones: II—numerical approach and validation. *Progress in Earth and Planetary Science*, *10*(1), 1–29.