

AutoPDex Package

[1] The name of this package is called AutoPDEX. This package operates an open source partial differential equation solver utilizing the automatic code transformation capabilities of JAX. Jax is a python library for accelerator oriented array computation and program transformation and is designed for high-performance numerical computing and large-scale machine learning.

[2] I selected this package by navigating through arXiv to find the JOSS link. I browsed through that library and I came across this article on utilizing Jax to process an automated partial differential equation solver. As a person who loves math, I was intrigued. This package is closely related to MATH 243 which is Introduction to Linear Algebra and Differential Equations.

[3] This package was submitted on September 17th, 2024 and was published on April 11th, 2025.

[4] This package is still maintained by the Tobias Bode, author of this project. In this software repository and by scrolling all the way to bottom, there are instructions to contribute to this project via contribution guidelines.

[5] It was a little challenging at first because I had to figure out which examples I want to use. I went to docs, then notebook, and found which example I wanted to use. Before running the notebook, there were some pip that I had to install in which I'll convey in the next question.

[6] It can be installed via the "standard" pip/conda. I've installed using these codes one at a time: `!pip install autopdex`, `!pip install meshio[all]`, `!pip install nanomesh`, `!pip install pyvista[all]`, `!pip install trame ipy widgets`, and `!pip install - user pyparidiso`. After installing these pips, I restarted my kernel and I was able to use the notebook.

[7] The source codes for this packages are available and can be inspected via Github.

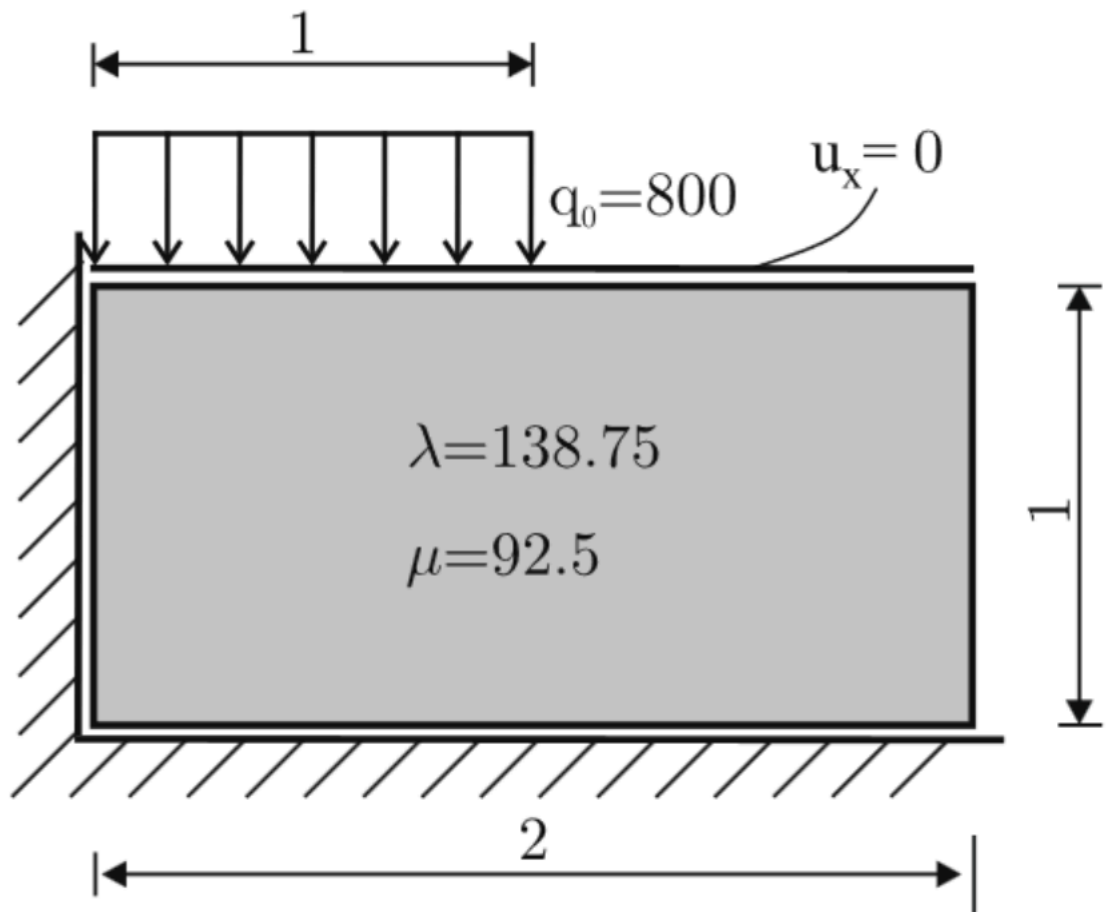
[8] This code can be used along with other packages such as Gmsh, and Paraview. Gmsh is an open source 3d finite element grid generator and it provides meshing tool with parametric input and advanced visualization capabilities. Paravista is end-user tool that is used to view large data.

[9] This code can be used as both a python script and a jupyter notebook(mainly).

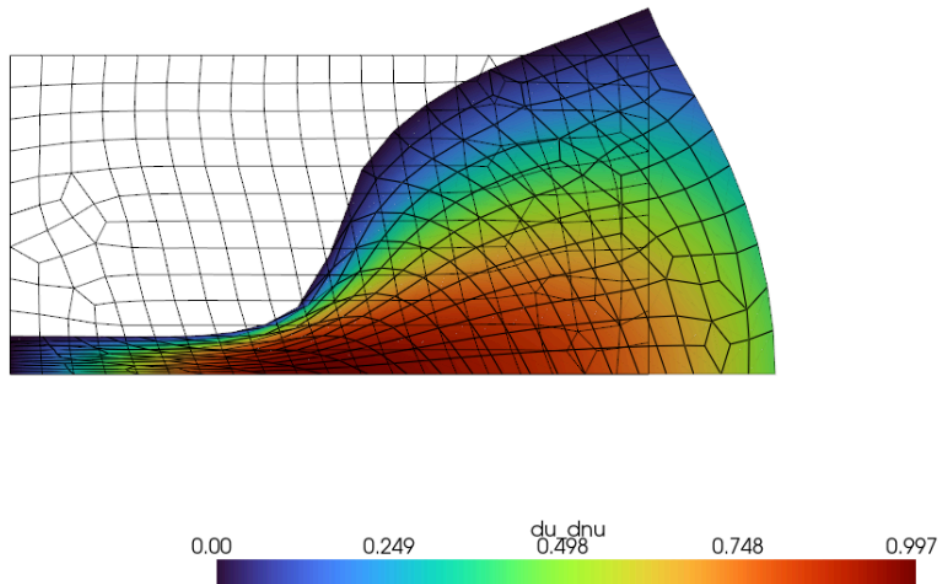
[10] The accompanying notebook will display how I use the code.

[11] This package does produce figures. Instead of using matplotlib, we use Gmesh, Pyvista, and Paraview for data visualization

[12]



Hyper Elastic Mechanical Punch Problem(This figure wasn't made. It use to show what we looking for and how to solve it)



Actual Result and Description displayed

[13] This package is purely python.

[14] The input to this package in general can range from parameters, datasets, and different forms of differential equations that you want to solve and/or display.

[15] The output to this package in general are similar to the input such as can range from parameters and datasets, but the output could also be figures.

[16] This package didn't provide any unit tests, regression, or benchmarking. However, after testing the code multiple times, restarting the kernel is guaranteed to work from my experience.

[17] Following up from the last question, I generally feel confident that this code could produce reliable results. If I'm dealing with big examples of this code, I would need to restart the kernel.

[18] This package uses some form of numpy package and I found this out by looking at the top where there were a plethora of package imports.

[19] This package ranges from documentation via JOSS. There is also a folder called paper to read a more thorough summary on this package. In the folder of docs and examples, you see a plethora of examples utilizing autopdex.

[20] Yes, the preferred citation method is "Bode, T., (2025). AutoPDEx: An Automized Partial Differential Equation solver based on JAX. Journal of Open Source Software, 10(108), 7300, <https://doi.org/10.21105/joss.07300>"

[21] Reference:

- Jax <https://github.com/jax-ml/jax> , <https://docs.jax.dev/en/latest/>
- Gmesh <https://onlinelibrary.wiley.com/doi/10.1002/nme.2579>
- Pyvista <https://joss.theoj.org/papers/10.21105/joss.01450>
- ParaView
[https://www.sciencedirect.com/science/article/abs/pii/B9780123875822500381?](https://www.sciencedirect.com/science/article/abs/pii/B9780123875822500381?via%3Dihub)
[via%3Dihub](https://www.sciencedirect.com/science/article/abs/pii/B9780123875822500381?via%3Dihub)

[22] I haven't found other papers using this package.

[23] This class was sufficient enough for me to get through this project.

[24]I do not have prior experience in using this packages.