FYS-4096 Computational Physics, exercise 11

Return your solution to project `exercise11` under your GitLab group for this course by Friday **April 6th** at 5 AM.

Your Easter holiday is from March 28th to April 3rd, and there's no teaching nor any exercises during that time!

Tag the final version with `final` keyword, and make sure to include a file `problems_solved` in the repository. The `problems_solved`-file should be a comma separated list of problems you have solved.

Problem 1 (2 XP)

Tsunamis can be caused by a sudden collapse of the seabed. An originally flat seabed collapses and water rushes in to replace the void (see the figure below). The resulting disturbance causes a wave to propagate away from the source. We start our modeling right after this collapse, and model only in 1D.

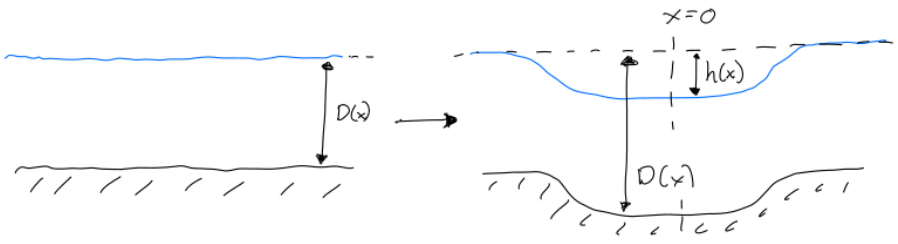

Figure 1: alt text

Write down 1. the governing wave-equation as two coupled PDEs that are first order in time, 2. the initial conditions for the PDEs 3. the weak formulation of the problem [set the boundary term(s) to zero] using implicit Euler's rule for the time-derivative(s).

Include your solution as a PDF in your git repo.

Hint: Eq. 9.21 of R. Salmon, Introduction to Ocean Waves might be helpful.

Problem 2 (6 XP)

Solve problem 1 numerically using `fenics`/`dolfin` for times '$t \in [0s, 30s]$' when the seabed after the collapse has the form '$D(x) = -1 - \frac{1}{1+\exp[(|x|-20)/4]}$'. Use a large simulation box with periodic boundary conditions to simulate an infinite domain.

Finally, make a 2D-density plot of the resulting wave with time on the horizontal axis, and 'x'-coordinate on the vertical axis, and include your figure (PDF) in the git repo.

Extra: Solve also using some Runge-Kutta method for time-stepping (+ 3 XP)

Problem 3 (2 XP)

Provide feedback via

https://www.webropolsurveys.com/S/3C65A7DB607C0702.par