Grid Crossing

Parameters

For the Oedometer problem:

Quantity	Symbol	Value	Unit
Density	ρ	$1 \cdot 10^3$	$\mathrm{kg/m^3}$
Young's modulus	E	$1 \cdot 10^5$	Pa
Gravitational acc.	g	-9.81	$\mathrm{m/s^2}$
Load	p_0	0	Pa
Height	H	1	m

For the vibrating string with free end:

Quantity	Symbol	Value	Unit
Density	ρ	1	$\mathrm{kg/m^3}$
Young's modulus	E	100	Pa
Gravitational acc.	g	0	$\mathrm{m/s^2}$
Load	p_0	0	Pa
Height	H	25	m

For the test problem of Steffen et al.:

Quantity	Symbol	Value	Unit
density	ρ	100	$\mathrm{kg/m^3}$
Young's modulus	E	100	Pa
length	L	1	m
amplitude force	τ	1	$-$

Figure: internal force and pulse

The figure was made with 10 elements and 2 PPC. A timestep was chosen of $\Delta t = 0.001$.

As an alternative, we can also use the one I used during one of the meetings. (If you want, I will check the parameters/number of elements etc. for that figure.)

Figure: velocity

Vibrating string with free end

Two plots were made. The first one without grid crossing were we defined 30 elements and 4 PPC. The seconde one with grid crossing were we defined 60 elements and 4 PPC. In both cases a time step was used of $\Delta t = 0.01$ s.

I think that these plots show nicely that grid crossing is a serious issue. (And that our code works)

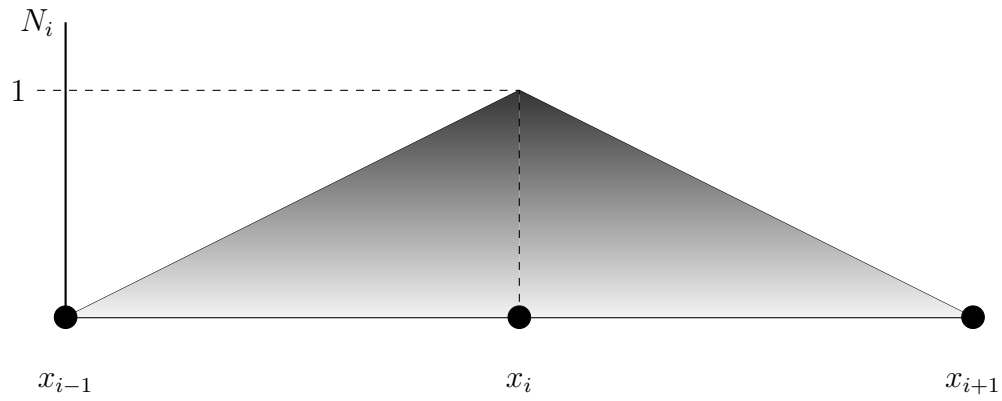
Test problem Steffen et al.

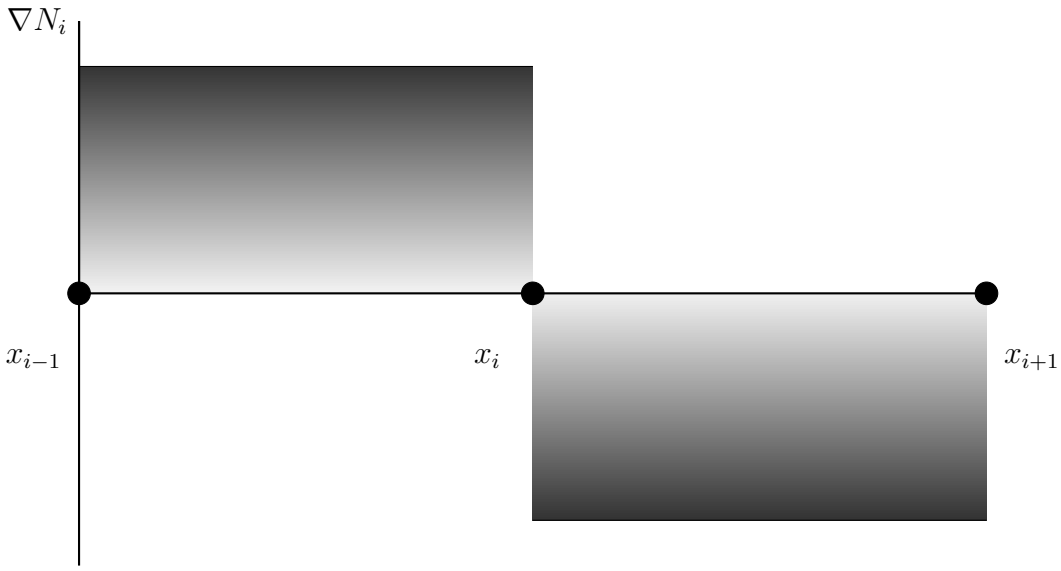
At this moment, there is no plot of the velocity implemented in the code (since it was not given in the paper). If you want I can implement it to obtain plots of the exact and obtained velocity.

Oedometer problem

Three plots were made. All of the plots were made with 30 elements and 10 PPC. A time step was used of $\Delta t = 0.001$ s. We have the following flavours:

- MPM solution and 'exact' solution.
- MPM solution and ULFEM solution, both of node situated halfway.
- MPM solution and ULFEM solution, MPM with particle situated halfway, ULFEM with node situated halfway.


N_i
1
x_{i-1}
x_i
x_{i+1}


∇N_i
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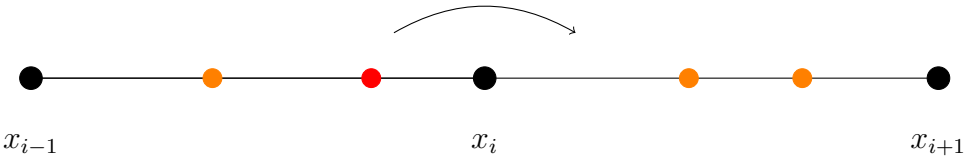
x_{i-1}
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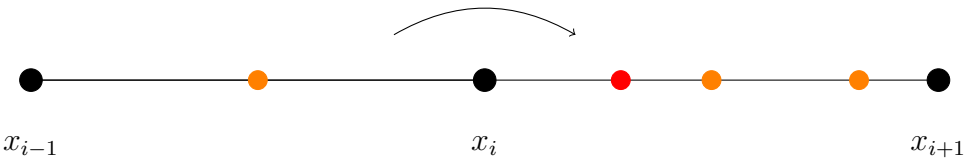
x_{i-1}
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