Understanding flow slides in flood defences

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February 2, 2016

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Recap

Last time:

- Accuracy vibrating bar with MATLAB and Fortran
- Courses

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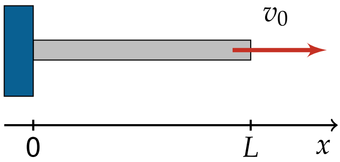
Work in progress:

- Accuracy tests for oedometer
- Reading papers on liquefaction:
  - Byrne and Eldridge, A three parameter dilatant elastic stress-strain model for sand (1982)
  - Byrne et al., Numerical modeling of liquefaction and comparison with centrifuge test (2004)
- Started writing first year report

Outline

- Accuracy vibrating string revisited
- Accuracy oedometer with Fortran implementation
- Validation of 2-phase FEM
- Elastoplastic model
- Boston
- Short term planning

Vibrating bar



$$\frac{\partial^2 u}{\partial t^2} = \frac{E}{\rho}\frac{\partial^2 u}{\partial x^2}$$

Boundary conditions:

$$u(0,t) = 0$$

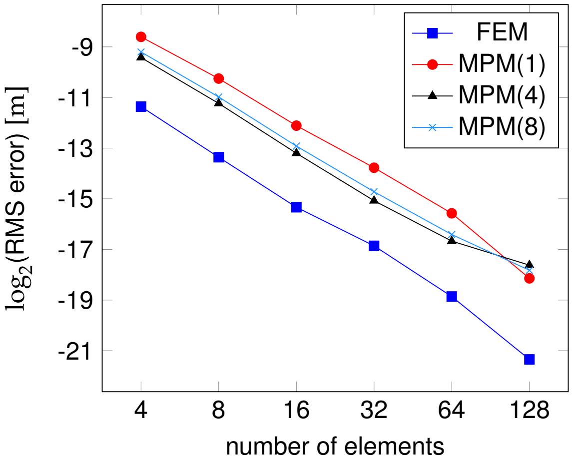
$$\frac{\partial u}{\partial x}(L,t) = 0$$

Initial conditions:

$$u(x,0) = 0$$

$$\frac{\partial u}{\partial t}(x,0) = v_0 \sin\left(\frac{\pi x}{2L}\right)$$

Accuracy vibrating bar: Fortran



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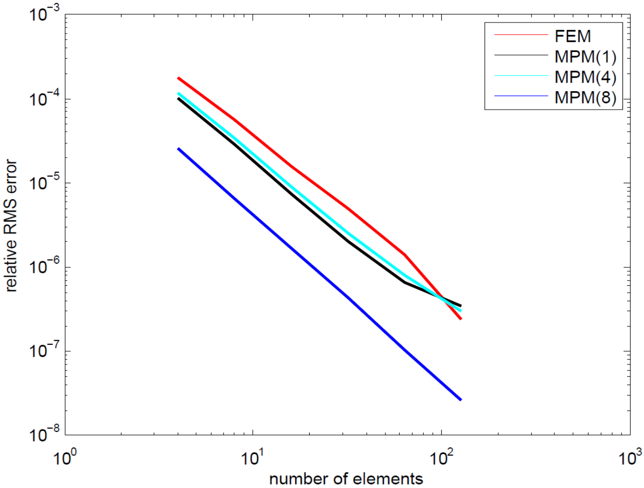

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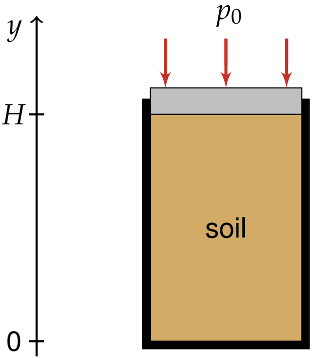
Oedometer (small deformations)



$$\frac{\partial^2 u}{\partial t^2} = \frac{E}{\rho}\frac{\partial^2 u}{\partial^2 y} - g$$

Boundary conditions:

$$u(0,t) = 0$$

$$\frac{\partial u}{\partial y}(H,t) = \frac{p_0}{E} = 0$$

Initial conditions:

$$u(y,0) = 0$$

$$\frac{\partial u}{\partial t}(y,0) = 0$$

Accuracy oedometer

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Accuracy oedometer

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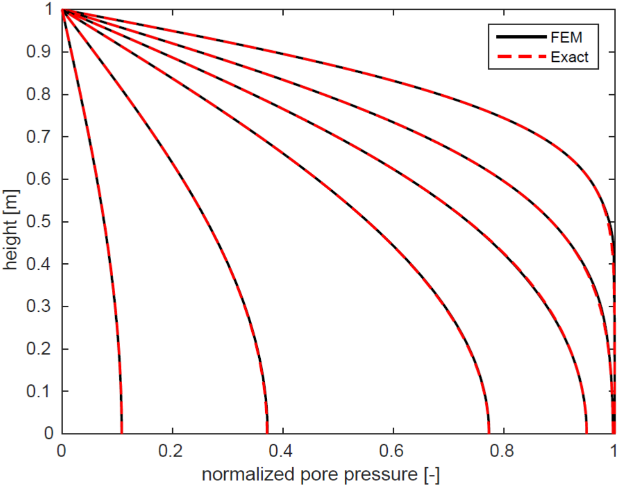
  Approaches used with FEM:
  - Absolute RMS error
  - Relative RMS error
  - Richardson (node on top)
  - Absolute RMS error with a gradual increase of the gravitational force

2-phase FEM: consolidation



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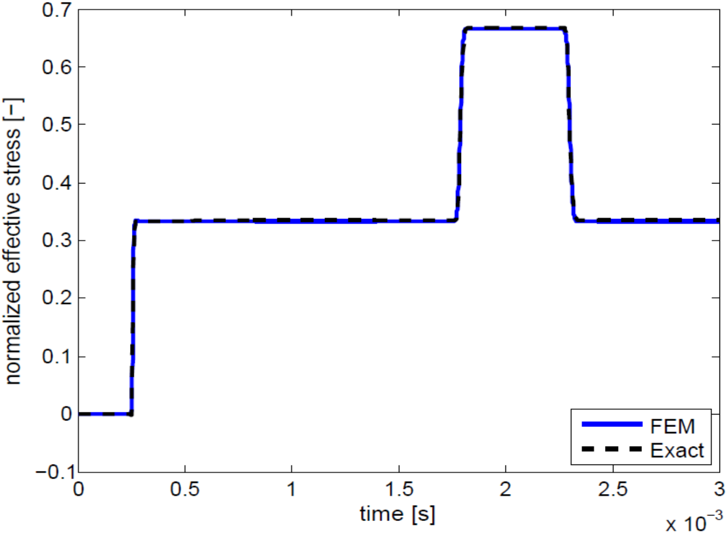
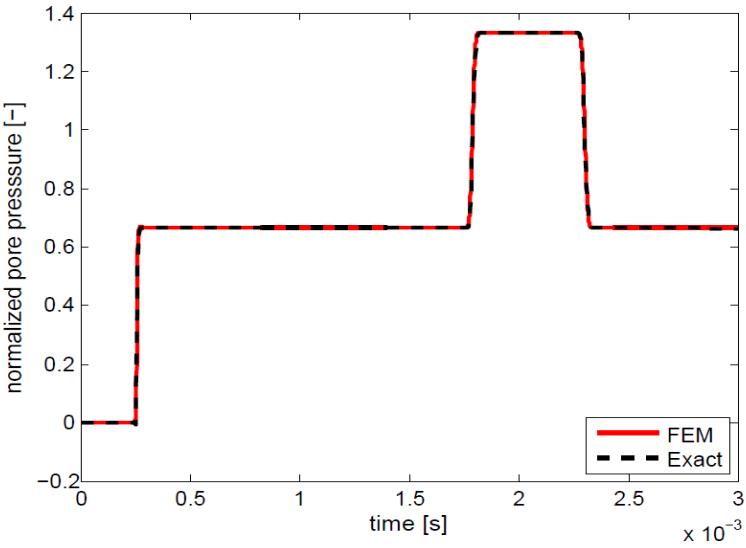
2-phase FEM: one-dimensional wave propagation



2-phase FEM: one-dimensional wave propagation



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- Informed researcher: 4 February and 18 February (and online sessions in between)
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- Computational Multiphase Flow (J. M. Burgercentrum, 6-8 April): registered

Work in progress

- 2-phase MPM implementation in MATLAB
- Reading Byrne et al., Numerical modeling of liquefaction and comparison with centrifuge test (2004)
- Started writing first year report

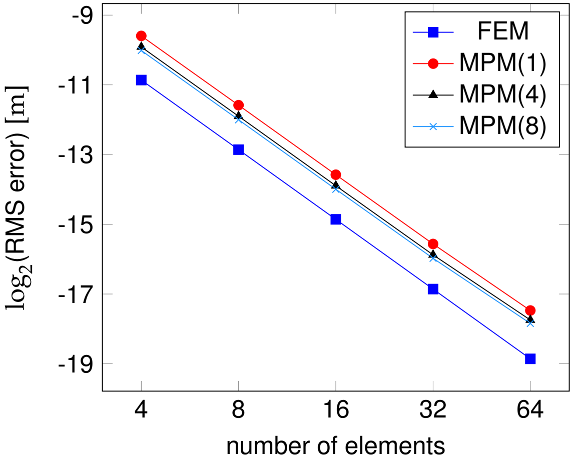
News

- Vice-president of SIAM student chapter in Delft
  - annual meeting in Boston 11-15 July
  - financial compensation
  - possible reduction of teaching obligations in 2016/2017

Settings: vibrating bar

	Symbol	Value	Unit
Length	L	25	m
Tension	E	100	Pa
Density	ρ	1	kg/m^3
Maximum velocity	v_0	0.1	m/s
Time step	Δt	$1 \cdot 10^{-3}$	s
Measurement time	t	0.5	s

Accuracy vibrating bar: MATLAB



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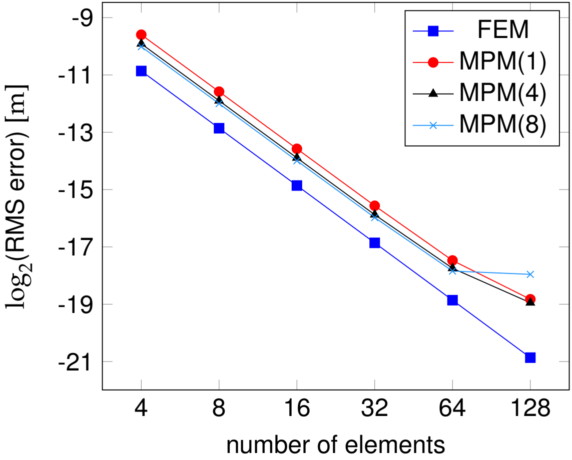
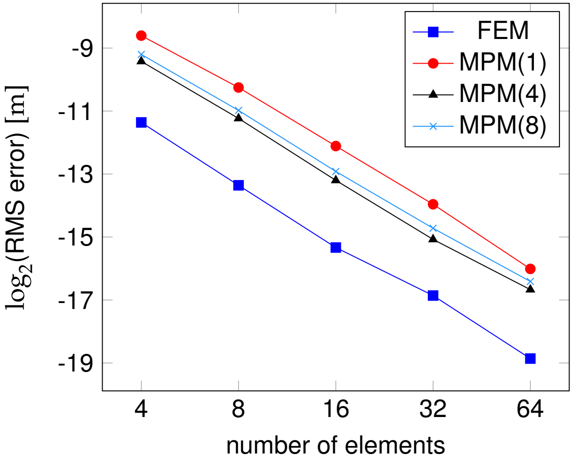


Accuracy vibrating bar: Fortran



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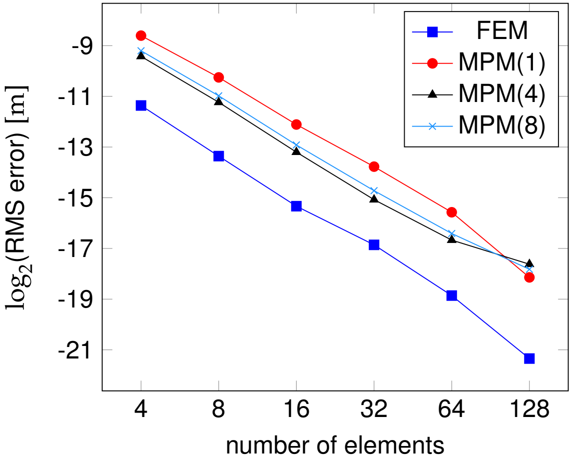
Accuracy vibrating bar: Fortran



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