Understanding flow slides in flood defences

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February 2, 2016

Recap

Last time:

- Accuracy vibrating bar with MATLAB and Fortran
- Courses

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Recap

Last time:

- Accuracy vibrating bar with MATLAB and Fortran
- Courses

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

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Outline

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

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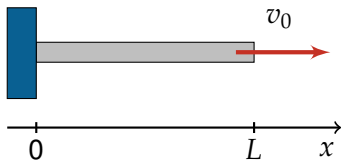
$$\frac{\partial^2 u}{\partial t^2} = \frac{E}{\rho} \frac{\partial^2 u}{\partial x^2}$$

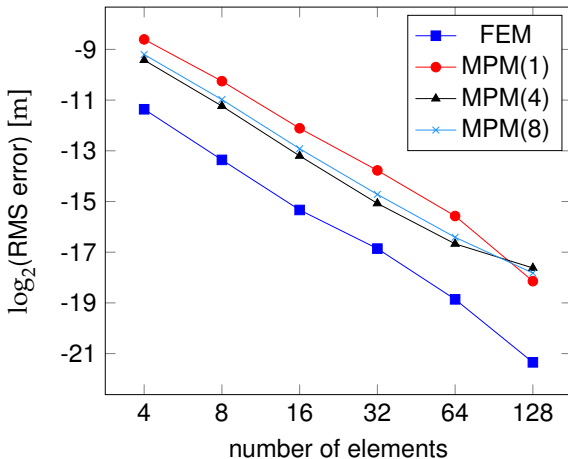Boundary conditions:

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

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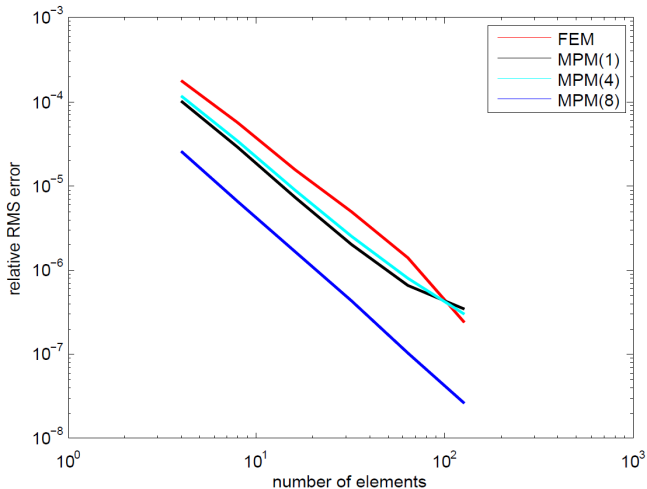
Initial conditions:

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

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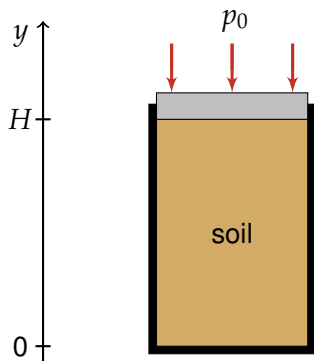
Accuracy vibrating bar: Fortran

Accuracy vibrating bar: Fortan

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

- MATLAB: lack of convergence with FEM and MPM

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Accuracy oedometer

- MATLAB: lack of convergence with FEM and MPM
- Fortran: lack of convergence with FEM and MPM

Accuracy oedometer

- MATLAB: lack of convergence with FEM and MPM
- Fortran: lack of convergence with FEM and MPM
  Approaches used with FEM:
  - Absolute RMS error
  - Relative RMS error
  - Richardson (node on top)
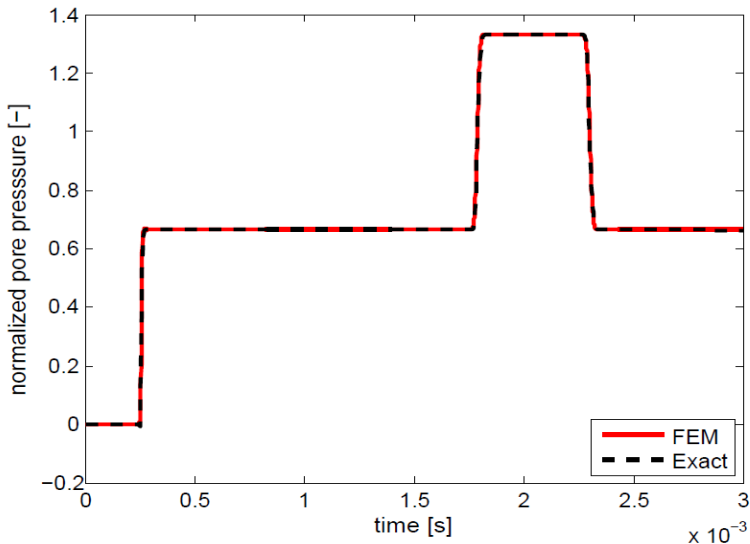 - Absolute RMS error with a gradual increase of the gravitational force

2-phase FEM: consolidation
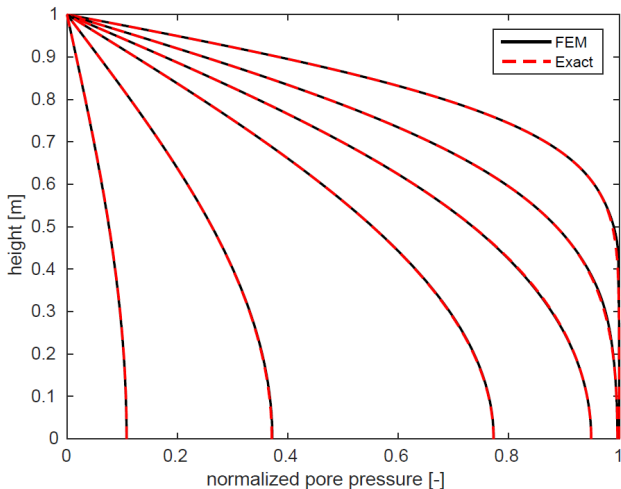
2-phase FEM: one-dimensional wave propagation
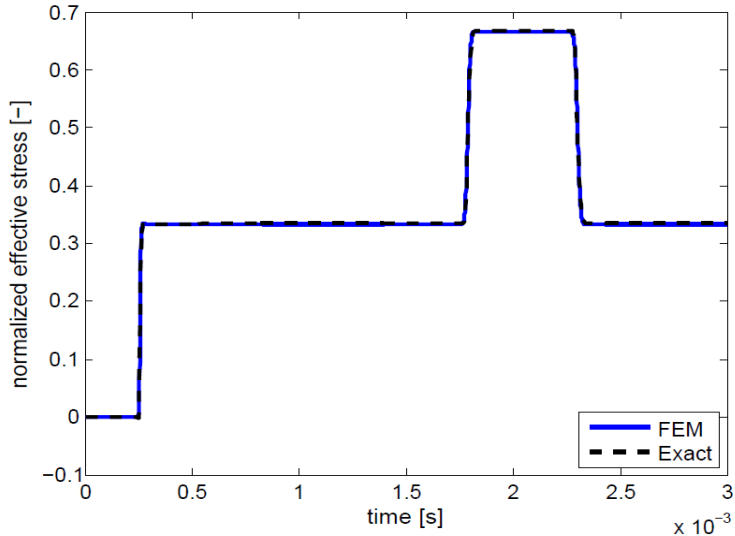
2-phase FEM: one-dimensional wave propagation

"Long" term planning

- Within FEM replace elastic material model by Drucker-Prager model

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"Long" term planning

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- Within FEM replace Drucker-Prager model by Mohr-Coulomb model (?)

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- Integrate FEM with models suggested by Byrne (Stolle)

"Long" term planning

- Within FEM replace elastic material model by Drucker-Prager model
- Within FEM replace Drucker-Prager model by Mohr-Coulomb model (?)
- Integrate FEM with models suggested by Byrne (Stolle)
- Switch to MPM for large deformations

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"Short" term planning/Work in progress

- 2-phase MPM implementation in MATLAB
- Reading Byrne et al., Numerical modeling of liquefaction and comparison with centrifuge test (2004)
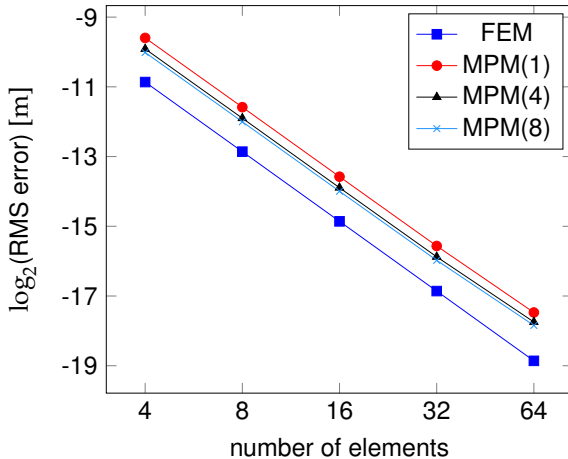
"Short" term planning/Work in progress

- 2-phase MPM implementation in MATLAB
- Reading Byrne et al., Numerical modeling of liquefaction and comparison with centrifuge test (2004)
- Appointment with Prof. Stolle
- Study Drucker-Prager model
- Write out the implementation of Drucker-Prager

Boston

- Submitted abstract
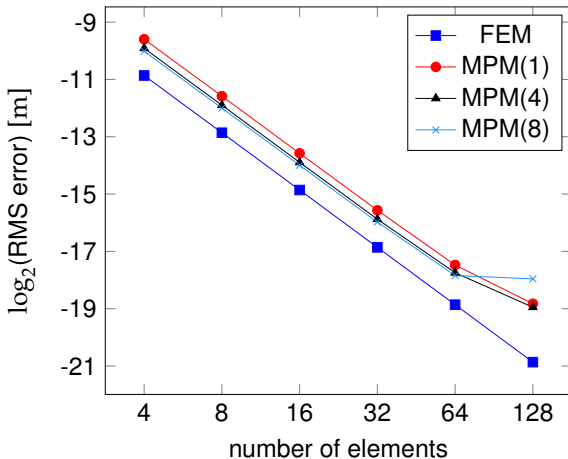- Trying to find financial support

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

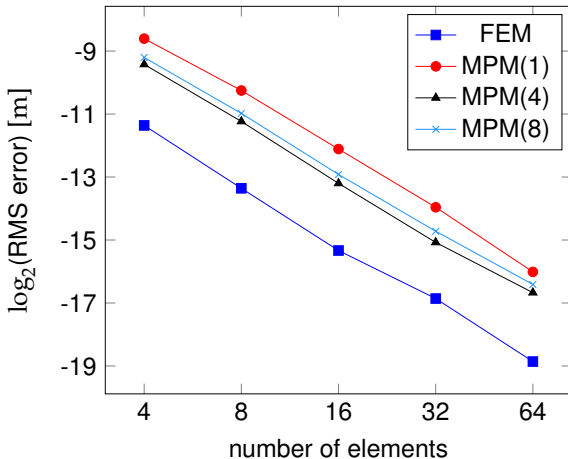# Accuracy vibrating bar: MATLAB

Accuracy vibrating bar: Fortran

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Accuracy vibrating bar: Fortran

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