

PCOG Yearly Team Meeting 2016

Xavier Besseron

LuXDEM team

<http://luxdem.uni.lu/>

My CV Updated!

2006–2010 PhD in Computer Sc. in Grenoble University

- Fault Tolerance and Dynamic Reconfiguration for large scale distributed applications

2010–2011 One-year Postdoc in Ohio State University

- Fault Tolerance in MVAPICH2 (ie MPI over InfiniBand)

2011–2016 Postdoc researcher here for 5 years

HPC for eXtended Discrete Element Method (XDEM)

- Engineering: LuXDEM Team with Bernhard Peters
- Computer Science: PCOG with Pascal Bouvry

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HPC for eXtended Discrete Element Method (XDEM)

- Engineering: LuXDEM Team with Bernhard Peters
- Computer Science: PCOG with Pascal Bouvry

2016–∞ Permanent position here!

- Research Associate in LuXDEM Team with Bernhard Peters
- Hoping for many good collaborations with PCOG & UL HPC

XDEM

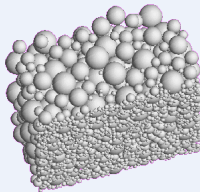
What is XDEM?

XDEM software is **multi-physics simulation** toolbox modeling granular materials and processes



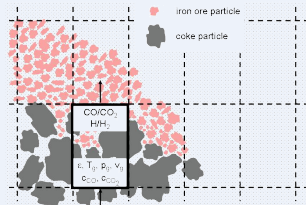
Particle Motion

Snow, Sand, ...



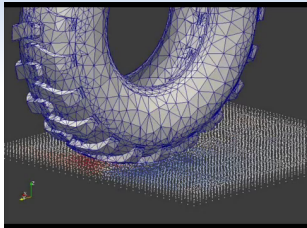
Chemical Reactions

Coke, Iron ore, Biomass, ...

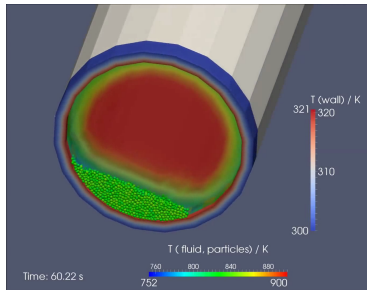


+ coupling external libraries: **CFD** with OpenFoam, **FEM** with Diffpack

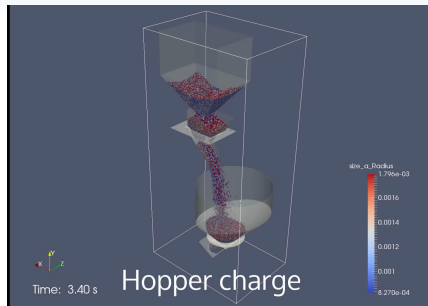
Examples



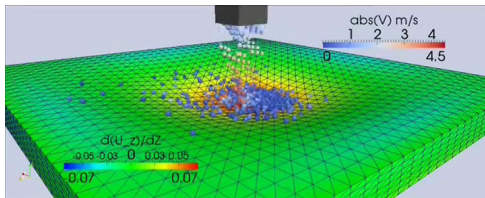
Tire on Snow
XDEM-FEM coupling



Heat transfer to the walls
of a rotary furnace
XDEM-CFD coupling

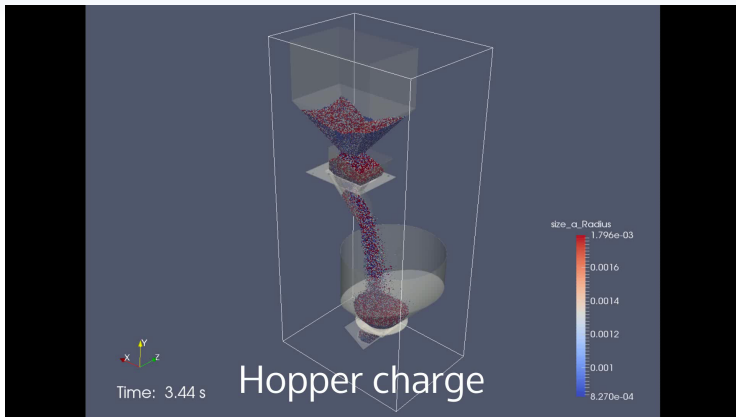


Charge/Discharge of hoppers



Impacts on an Elastic Membrane
XDEM-FEM coupling

XDEM needs HPC!



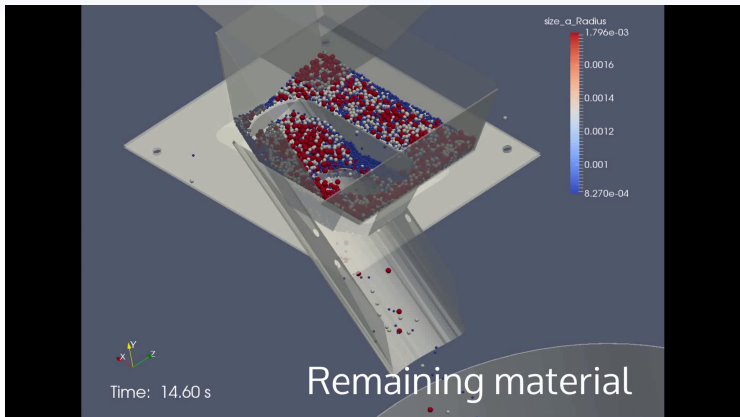
Hopper charge

- 15 s of simulation
- 92 hours with 120 cores
- Est. seq. time > 4 months

Hopper discharge

- 18 s of simulation
- 120 hours with 144 cores
- Est. seq. time > 6 months

XDEM needs HPC!



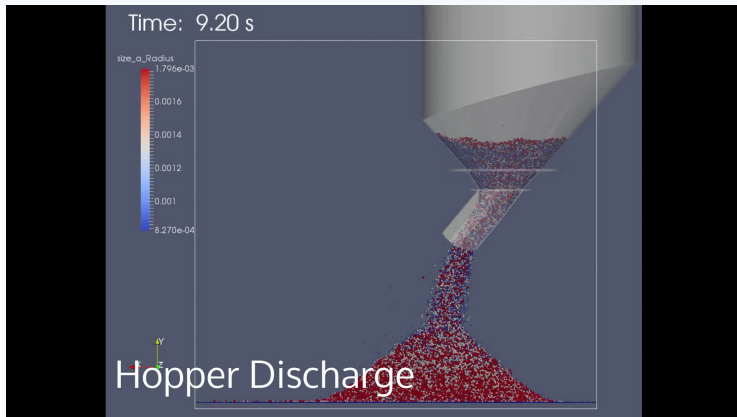
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Collaborations with PCOG

HPC vs Cloud: Cost study using XDEM

What is the cost of running an XDEM application?

- UL HPC vs Amazon EC2
- Metric: Dollars per Iteration

Extrapolated duration and price

- Testcase: Hopper charge 15s
- Full testcase with 750,000 timesteps
- Trade-off between deadline and cost

	Cheapest (24 processes)		Fastest (240 processes)	
Gaia Dell FC430	8.61 days	\$ 94.64	2.69 days	\$ 295.29
c4.8xlarge on-demand	11.81 days	\$ 540.55	3.50 days	\$ 1,602.84
c4.8xlarge reserved	11.81 days	\$ 345.48	3.50 days	\$ 1,024.44

Large Scale Simulation of DEM simulations (LSDEM)

- UL project
- Collaboration with LuXDEM and PCOG
- Improve performance of XDEM for large scale execution

1 PhD student

- Wahid
- To start in March/April

1 Postdoc

- Alban
- Started last September

Various things...

CloudCom'2016

- helping Seb
- time consuming...

UL HPC

- HPC Schools
- HPC workflows, Checkpoint/Restart, Visualization jobs with XCS
- Build software with EasyBuild & Modules
- ...

...

Thank you!

Any question?