



Université Libre de Bruxelles (ULB)

BATir department

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~8.515.000 km²
~190 M people



Google Maps

~12 hours
flight

~30.500 km²
~11 M people





Google Maps



~30.500 km²
~11 M people
200+ beers!



King of Belgium



King of Beers



Westvleteren

<http://batir.ulb.ac.be/>
pberke@batir.ulb.ac.be



but also!



<http://www.leonidas-chocolates.ca/GeneralAssortLG.jpg>

(much) better than
Swiss chocolate!

85% of rough diamonds
50% of cut diamonds
40% of industrial diamonds



http://3.bp.blogspot.com/-VjGOeCb1vIU/TzQu0mKNQJ/AAAAAAAAAB/Sg/tnlQgmh3K1g/s400/a+diamond_b.jpg

French fries = Belgian speciality!



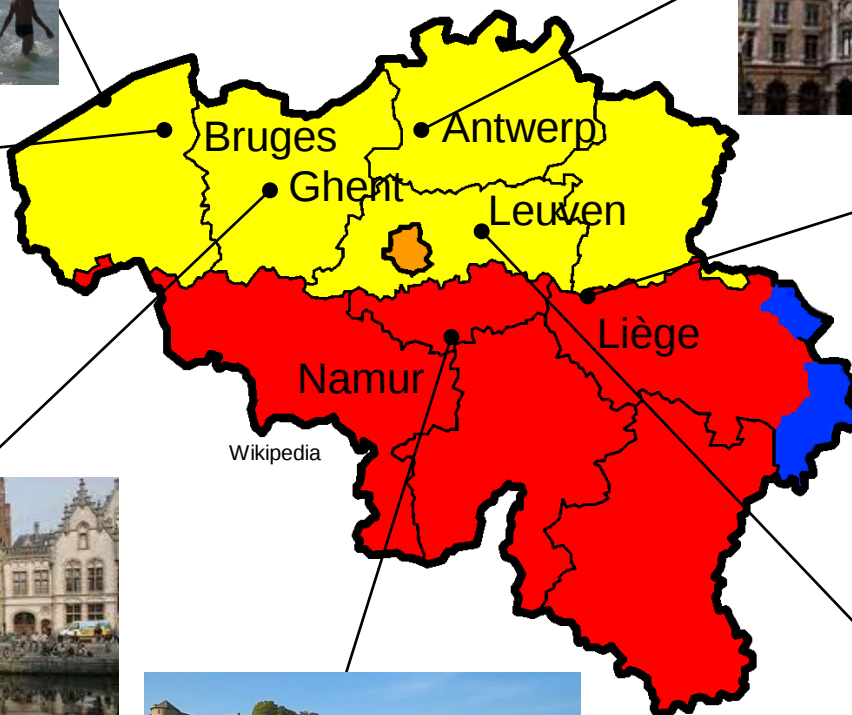
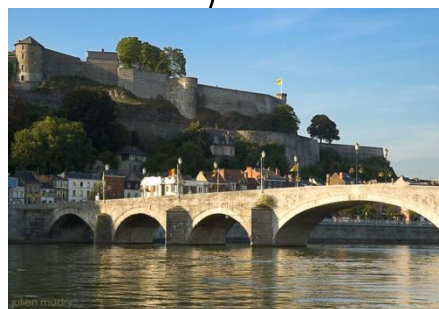
<http://belgianfrites.be/belgian%20frites.png>

“Gaufres de Bruxelles”



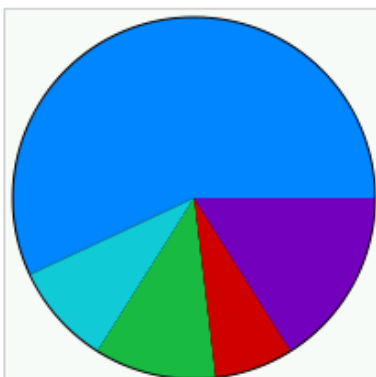
http://1.bp.blogspot.com/_WOyL8z6zoV0/TLcbDf2CdZI/AAAAAAAAABsk/Mh8d0B0XBSA/s1600/P1080487.JPG

[http://batir.ulb.ac.be/
pberke@batir.ulb.ac.be](http://batir.ulb.ac.be/pberke@batir.ulb.ac.be)





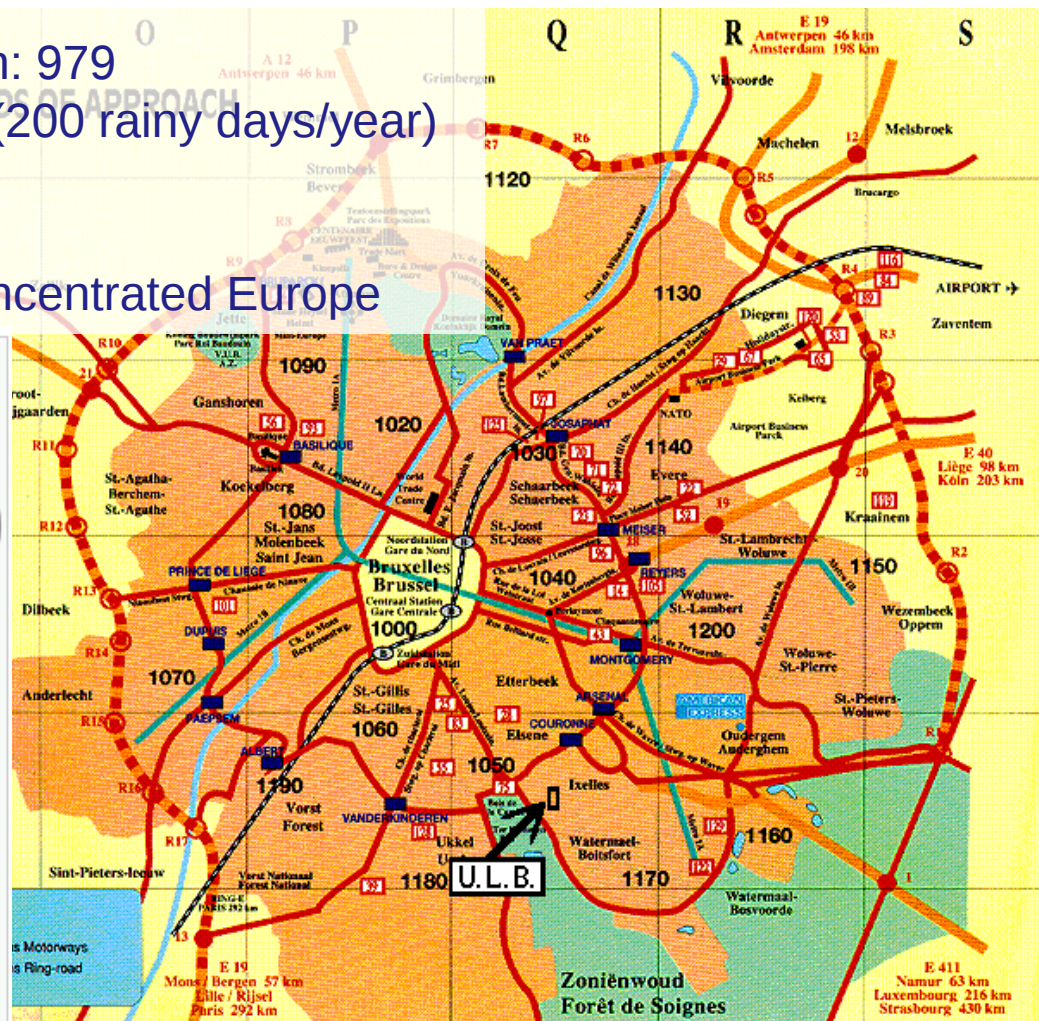
~1,8 M people
Official foundation: 979
Maritime climate (200 rainy days/year)
EU institutions
NATO
Multicultural – concentrated Europe



Estimate of languages spoken at home
(Capital Region, 2006) [52]

- French only (57%)
- French & Dutch (9%)
- French & non-Dutch language (11%)
- Dutch only (7%)
- Neither French nor Dutch (16%)

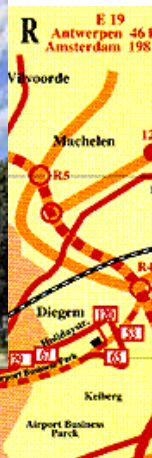
wikipedia.org





9
rainy d

trated B



wikipedia.org





ULB in numbers

630 FTE academic

1500 FTE scientific

1600 Ph.D. students

~21000 students

20 faculties and entities

Libre?

"...We swear to inspire our students, whatever would be the subject of the teaching be, the love of mankind, without distinction of caste, of opinion, of nation; we swear to teach them to devote their ideas, their work, their talents to the prosperity and the development of their fellow-citizens and of humanity..."

Opening ceremony of ULB, 20th November 1834

"...To examine independently of any religious or political authority the great questions of mankind and society, questions that have to be considered continuously, to lift the human thought over material interest, to investigate freely the sources of truth, and of good."

P.-T. Verhaegen, speech to the King, 1854

International

27% of students

11 % of teaching staff

23 % of researchers

300+ Socrates/Erasmus agreements

300+ bilateral institutional agreements

~100 international research projects

Aiming for excellence

Henri Lafontaine (peace 1913)

Jules Bordet (medecine 1919)

Albert Claude (medecine 1974)

Ilya Prigogine (chemistry 1977)

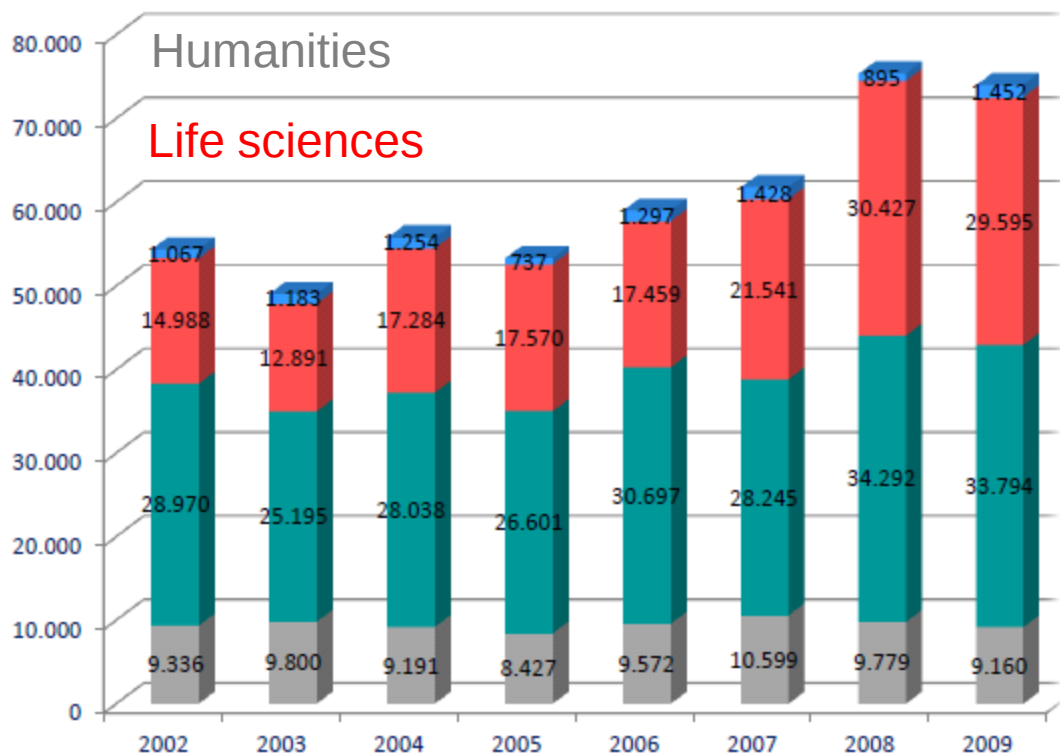
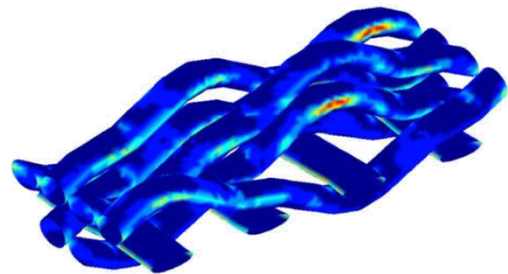
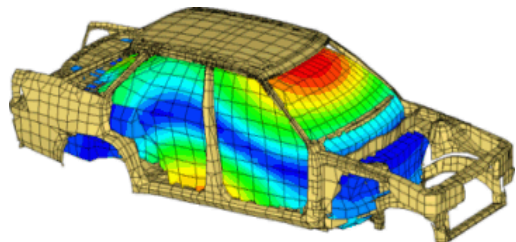




Research budget (2009) ~140.0 M€

~ 1500 publications/year (35% of CfB.)

~ 180 defended Ph.D./year (29% of CfB.)



Research contracts: ~74 M€





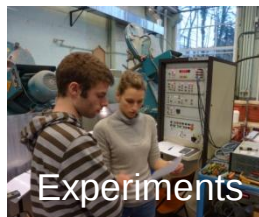
Ecole polytechnique de
Bruxelles (18 Res. units)



BATir dept.

Resources:

100 people, 50 FTE, 20+ Ph.D.



Town Planning

Spatial and temporal planning, Sustainable development, Cooperation for development, Port-city interface



Architectural Engineering

Theory of architecture, Risk analysis, Sustainable design, Energy flow in urban areas



Structural design and optimization



Civil Engineering

Early age cement-based systems, High performance concrete, Eco-concrete, Construction history



Structural dynamics and vibroacoustics



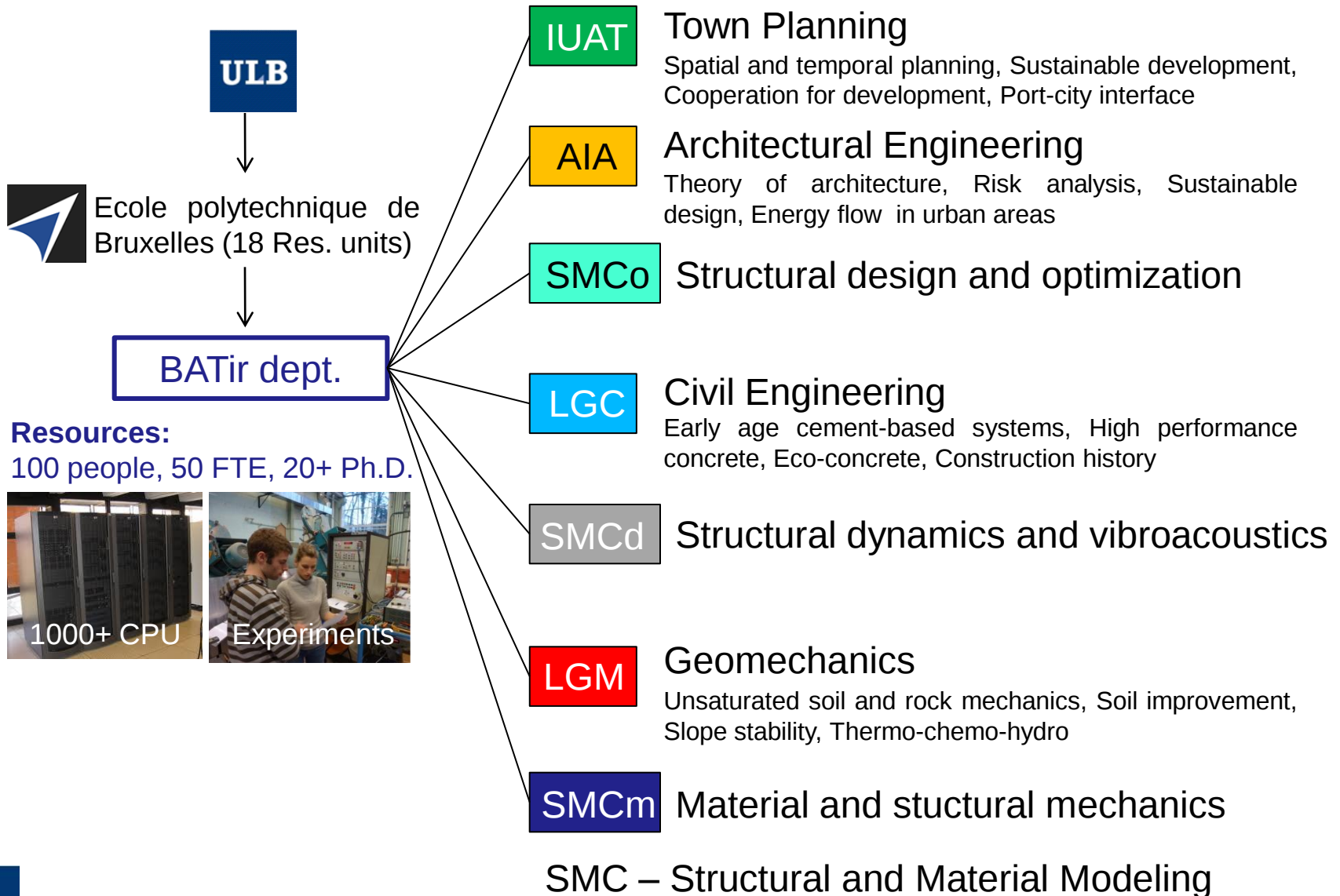
Geomechanics

Unsaturated soil and rock mechanics, Soil improvement, Slope stability, Thermo-chemo-hydro



Material and structural mechanics

SMC – Structural and Material Modeling



The energy performance of the urban form, a step towards sustainable development

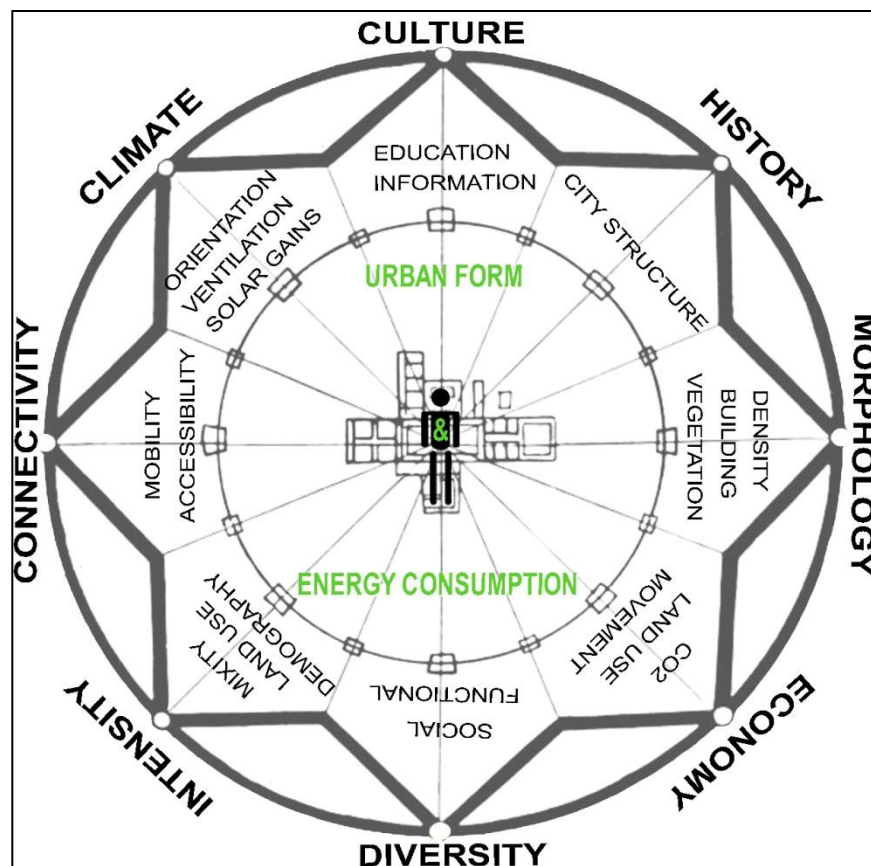
Researcher: S. Hermand Advisor: K. de Myttenaere

Multiscale assessment of the energy performance of urban forms.

1st level: elements of the composition of one urban area (climate, history, economic ...)

2nd level: elements impacting the energy consumption of one urban area (mobility, land uses ...)

Center: the user, the main entry point for the research





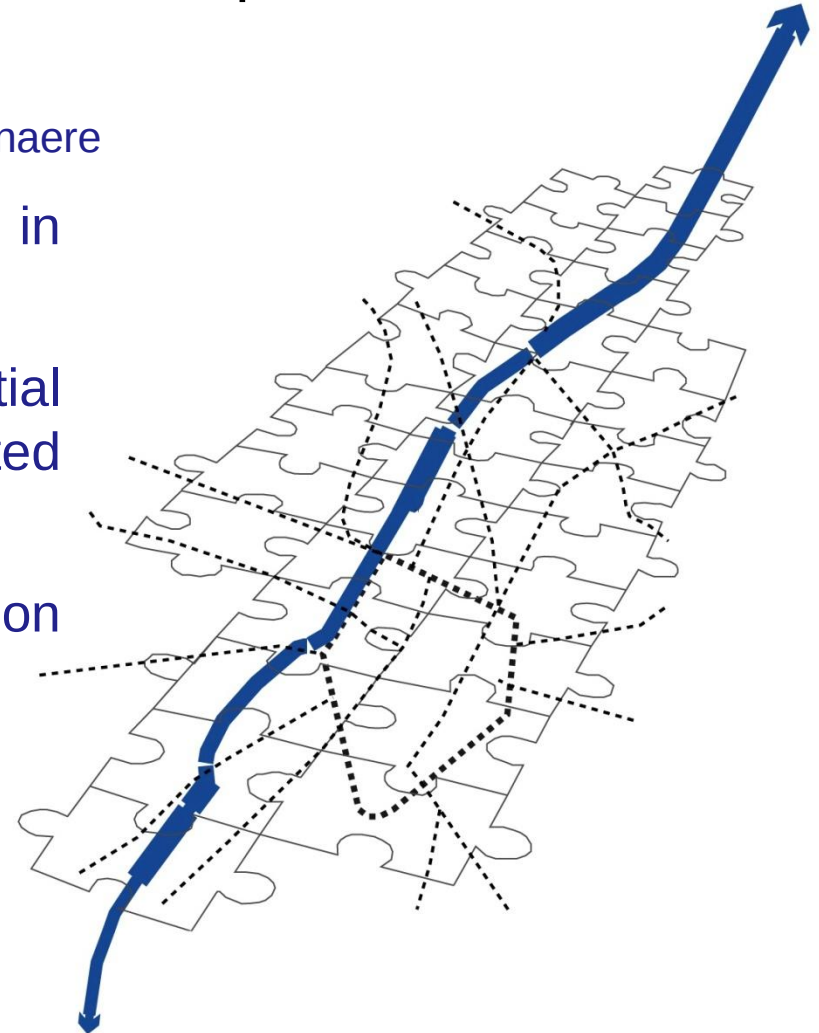
The Channel: a sustainable development vector for the Brussels-Capital region

Researcher: K. Mazy Advisor: K. de Myttenaere

Rethinking the port-city interface in Brussels

Development of a method of spatial analysis for the integrated development of the territory

Diagnostic and conception based on a spatial approach

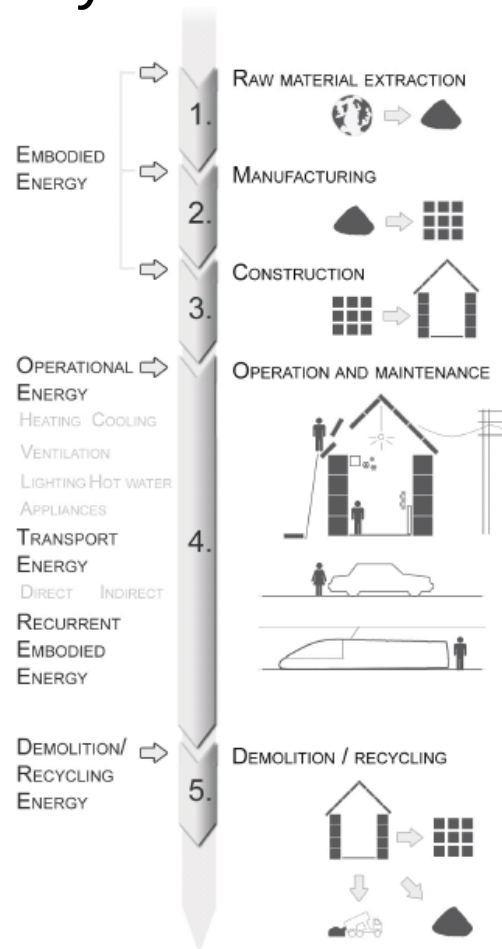
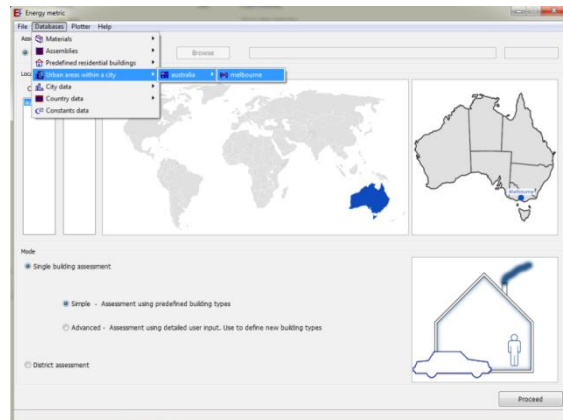


Towards a comprehensive energy assessment of residential buildings: multiscale life cycle analysis

Researcher: A. Stephan Advisor: K. de Myttenaere

Development a framework and a numerical tool to assess the life cycle energy demand of residential buildings

- embodied and user transport energy requirements (65% of E_{total}) are integrated (E_{oper} is only 35% of E_{total})



Environmental risk analysis for high-rise buildings in urban environments

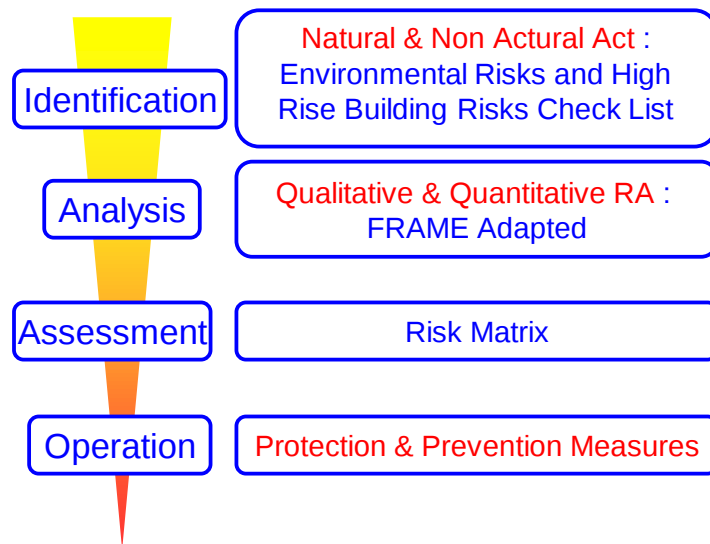
Researcher: Y. Dechamps Advisor: Ph. Bouillard, Y. Rammer

Assessment of the risks related to high-rise buildings in urban environments



WTC debris, Bankers Trust Building, 2001

[<http://911research.wtc7.net/mirrors/guardian2/wtc/fig-6-1.jpg>]



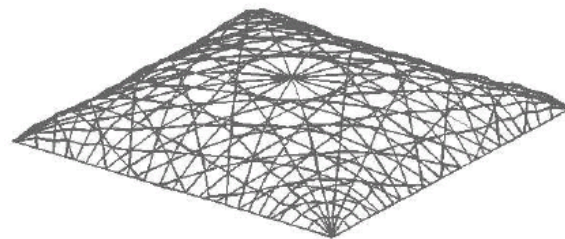
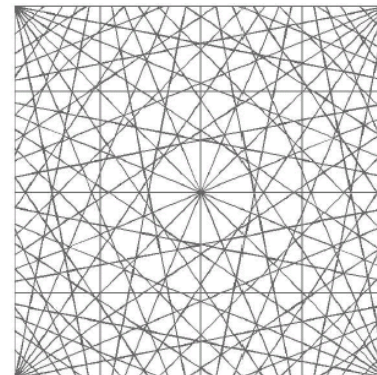


Form finding and multicriteria optimization under uncertainties

Researchers: J. Lebon, B. Descamps Advisor: R. Filomeno Coelho

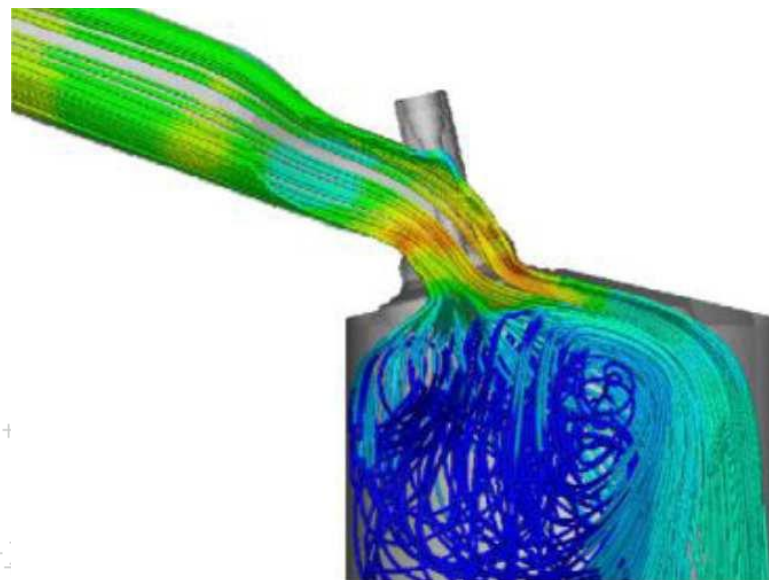
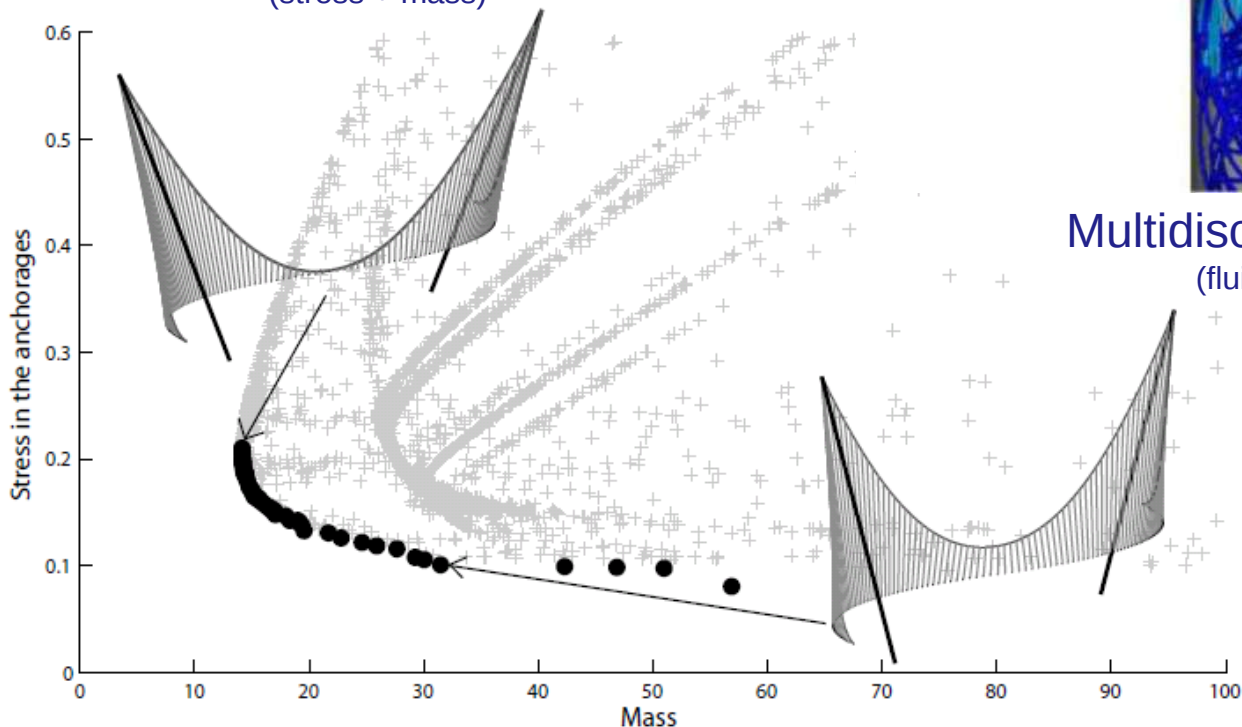


Maritime Museum, Amsterdam



R. Filomeno Coelho

Multiojective optimization (stress + mass)



Multidisciplinary optimization (fluid + structure + thermal)

Conservation and restoration of early reinforced concrete (RC) constructions in Belgium

Researcher: A. Hellebois Advisor: B. Espion

Experimental and theoretical study:

- Characteristics of reinforced concrete (1880 - 1914)
- Durability and bearing capacity of RC structures?



Testing to failure of an early reinforced concrete beam (1904) - span 6 m



Study of moment redistribution in prestressed reinforced concrete (RC) structures

Researcher: V. Everaert Advisor: B. Espion

Experimental and numerical study on continuous prestressed RC beams with unbonded tendons:

- Internal force distribution in ultimate limit state?
 - Linear/plastic model
 - Secondary moments
 - Reinforcement yield
- Tendon behavior?



Pre-stressed concrete structures are widely used in civil engineering for crossing wide spans (i.e. bridges)

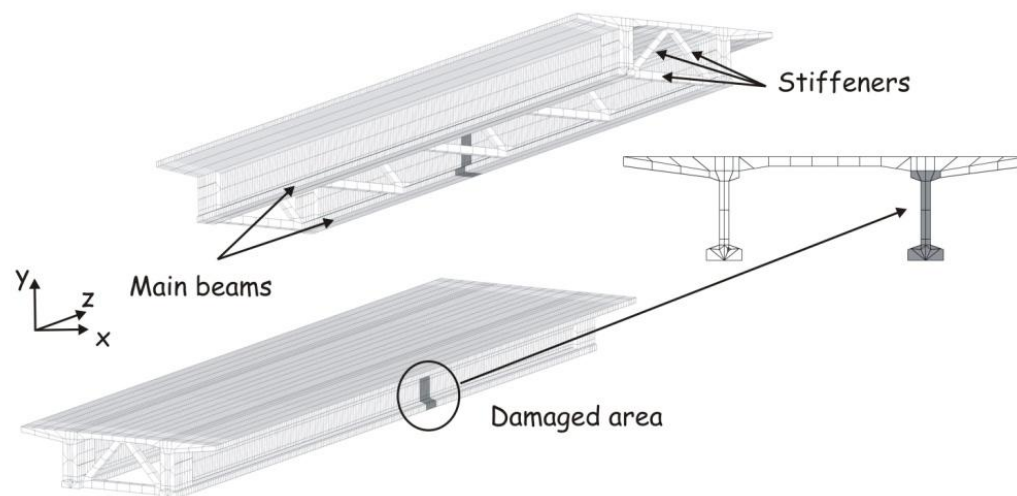
Automated strategies for online monitoring of structural health under variable environmental conditions

Researchers: G. Tondreau, M. Brehm, G. Karaiskos Advisors: A. Deraemaeker

Structural health monitoring based on vibration measurements



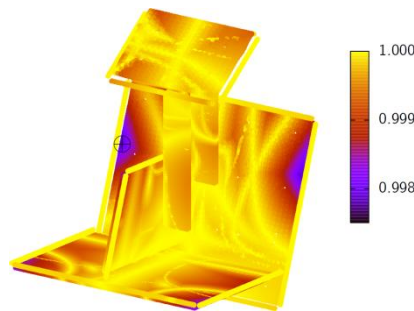
Bridge of Millau under construction
[unknown source]



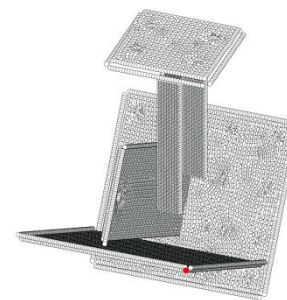
Data based automated damage detection and damage localization (efficient automated signal processing)

State of the art and novel sensor technology

Optimal placing of sensors



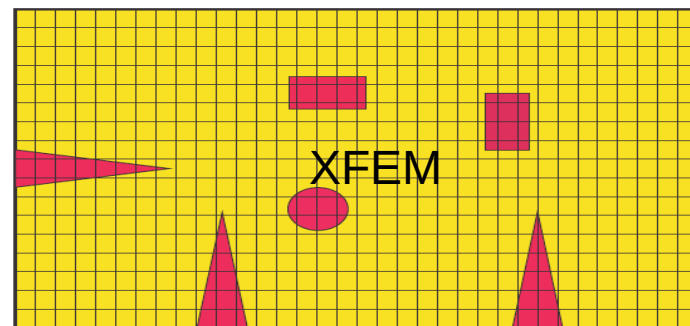
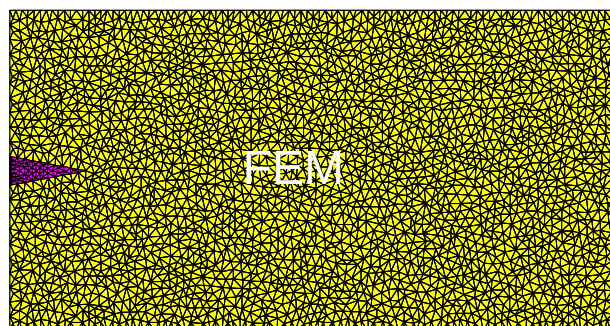
Assessment of possible positions



Best positions for two sensors

Mesh insensitive modeling of multiple sensor actuator configurations of plate like transducers (XFEM)

Researchers: S.R. Raman Advisors: A. Deraemaeker, Ph. Bouillard



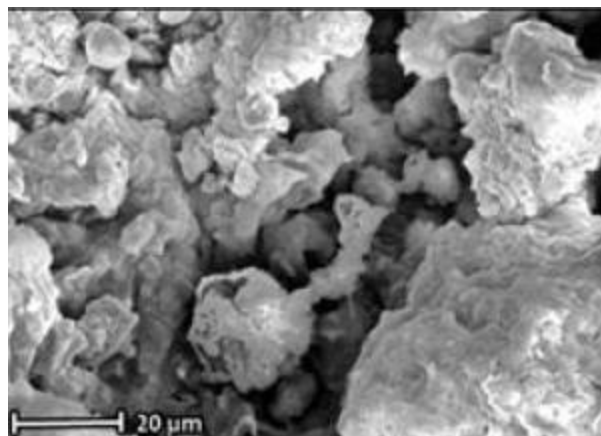
Study of the behaviour of unsaturated compacted soils, toward the consideration of their lime-treatment

Researcher : M. Oualmakran Advisor : B. Francois

Development of constitutive law for unsaturated soils integrating

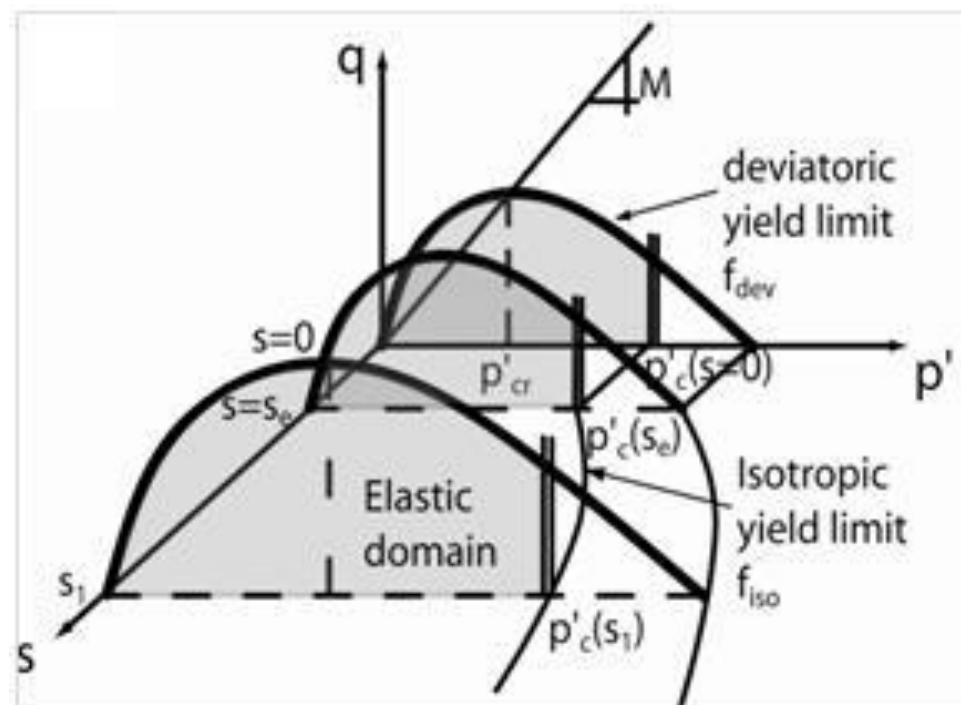
- Compaction and
- Water retention effects

Future: lime treated soils



Lime-treated clayey soil

De Bel, 2007



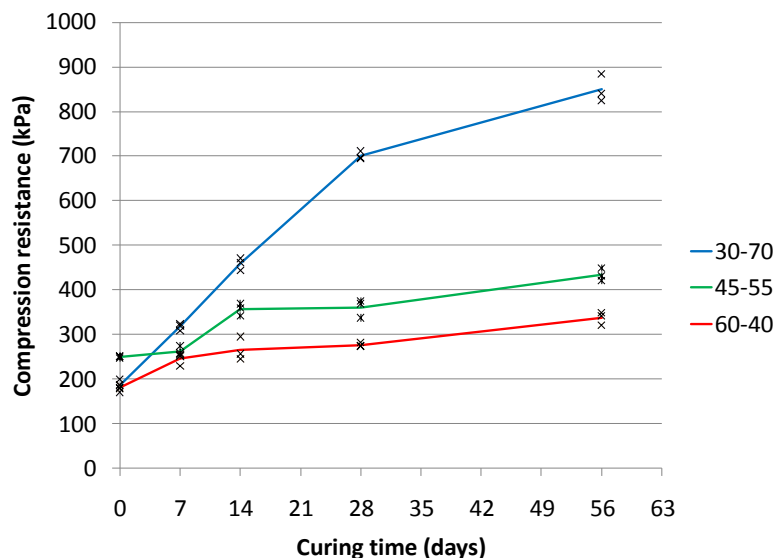
Mechanical properties of sand-bentonite mixtures stabilized with lime

Researcher: H. Mir Amid Advisor: T.J. Massart, B. François

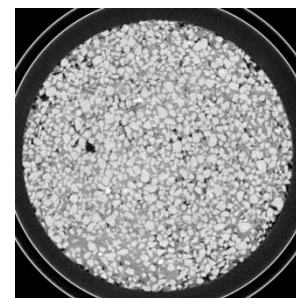
Experimental approach



+

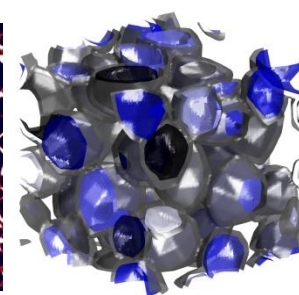
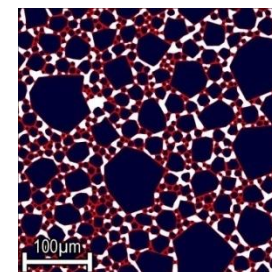


Unconfined compression tests: mixture with the lowest bentonite content (30%) exhibits the best mechanical properties.



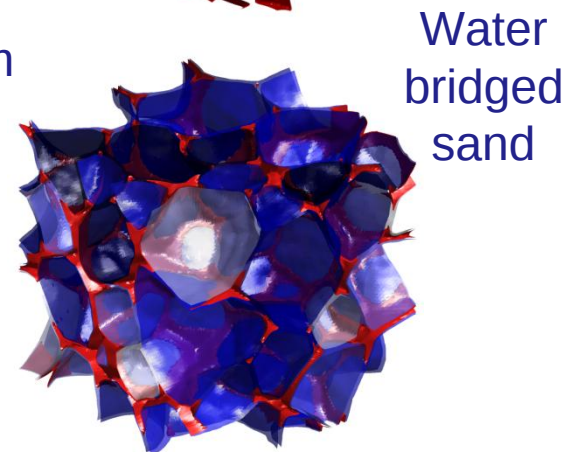
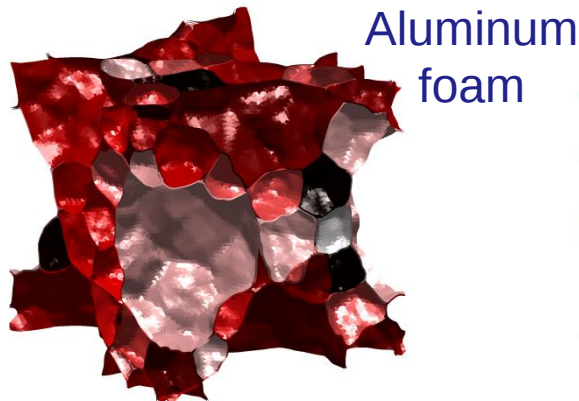
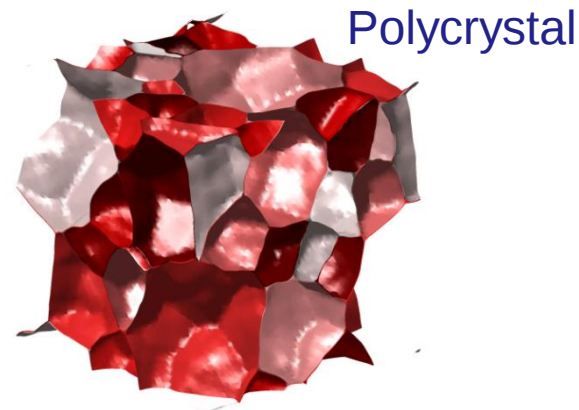
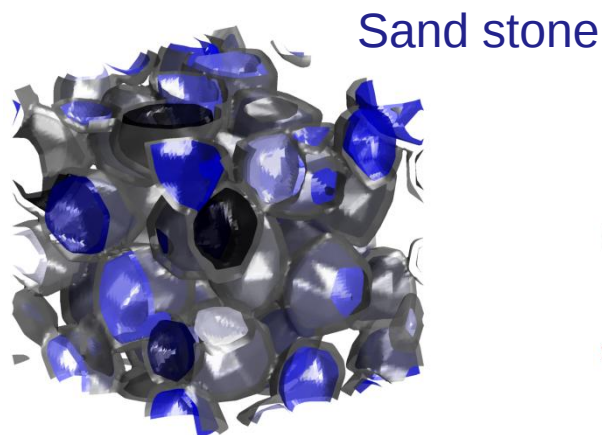
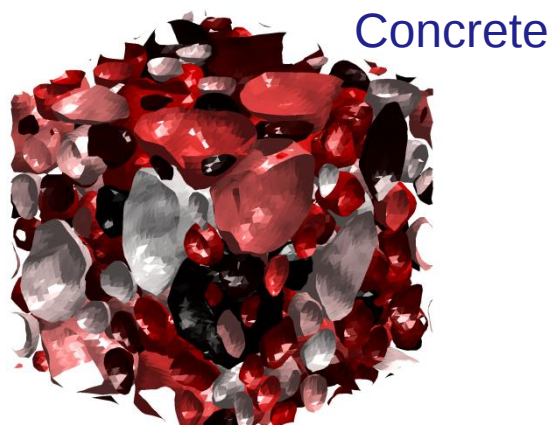
X-ray CT

Computational approach



Modeling of the lime treatment of soils – random RVE generation and XFEM computation

Researcher: B. Sonon Advisors: T.J. Massart, B. François



Computational modeling of the structural behavior of historical structures

T.J. Massart

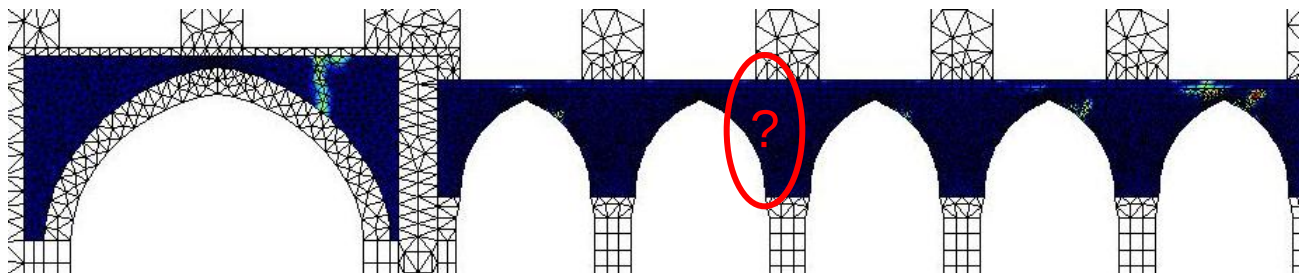
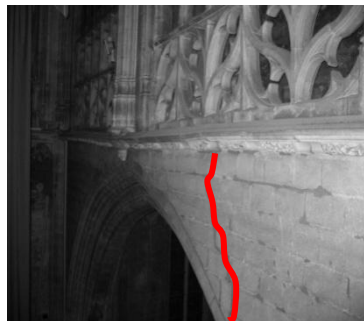


Notre-Dame au Sablon, XIII century

Safety and load bearing capacity?
Understanding and interpretation of damage?
Repair and reinforcement?

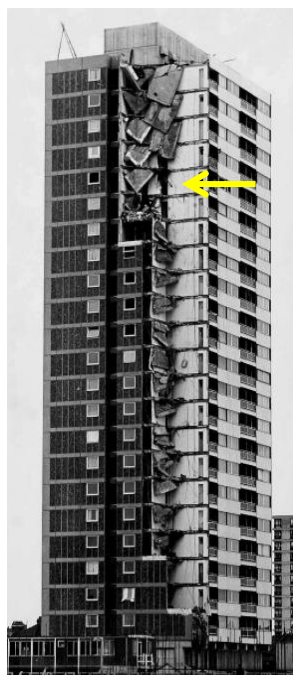
Computational results vs. observations

M. Provost



Computational modeling of the progressive collapse of RC structures – evaluation of structural robustness

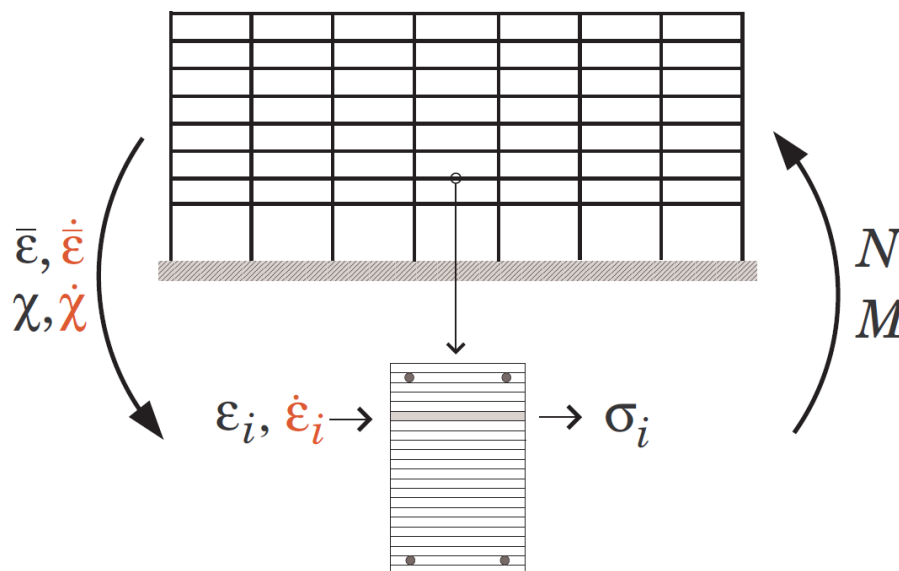
P.Z. Berke, T.J. Massart



Gas explosion,
London, 1968

[<http://partleton.co.uk/RonanPoint.jpg>]

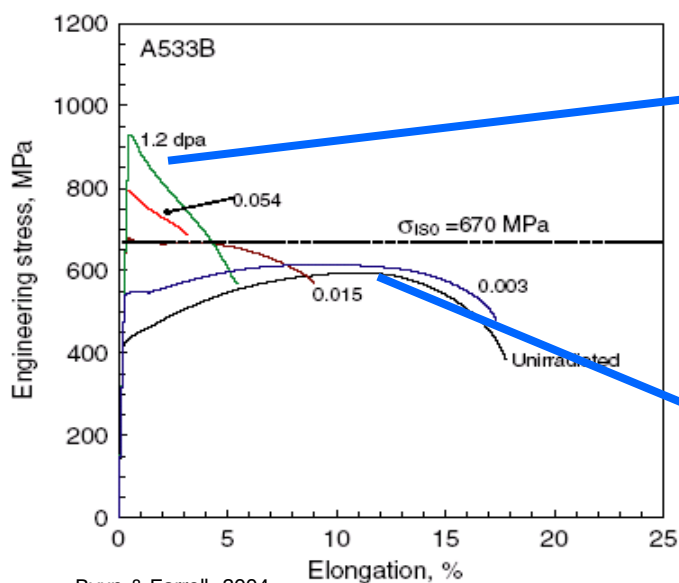
Physically-based multiscale approach for sectional and structural behavior
Dynamic framework, viscoelastic and viscoplastic material behavior



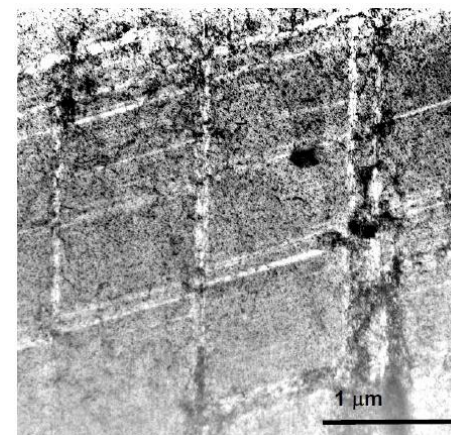
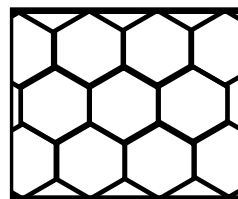
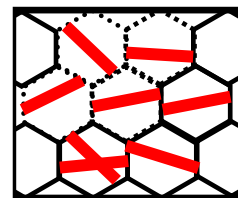
Small scale plasticity in metallic materials, the effects of confining the plastic flow

Researchers: M.Hatami, A. Pajot Advisor: T.J. Massart

Loss of ductility of irradiated metals vs. presence of clear bands?
Classical vs. strain gradient plasticity
Safety of nuclear installations



Byun & Farrell, 2004

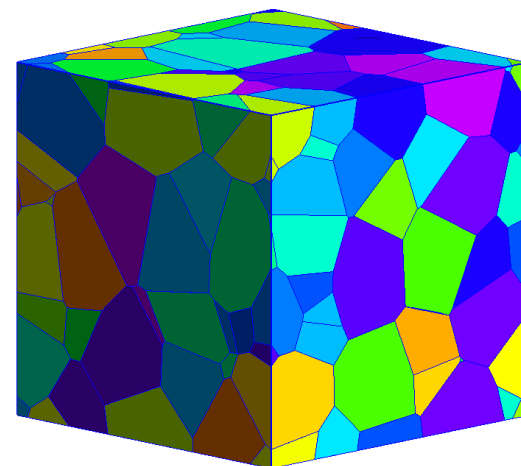
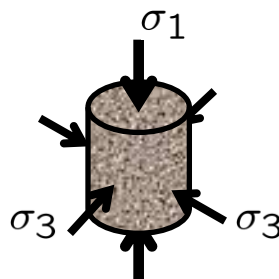
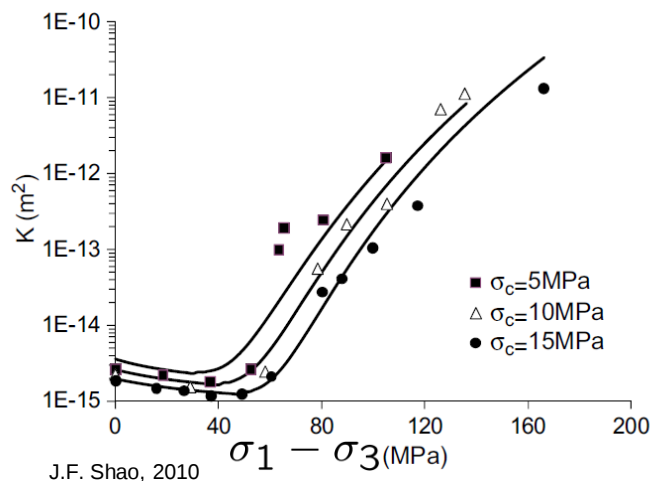


Clear bands in steel

Stress-induced permeability evolutions – safety of nuclear waste storage

B.C.N. Mercatoris, T.J. Massart

Permeability critical in many geo-environmental applications
Recover this property by computational homogenization
Multiscale modeling of hydro-mechanical couplings



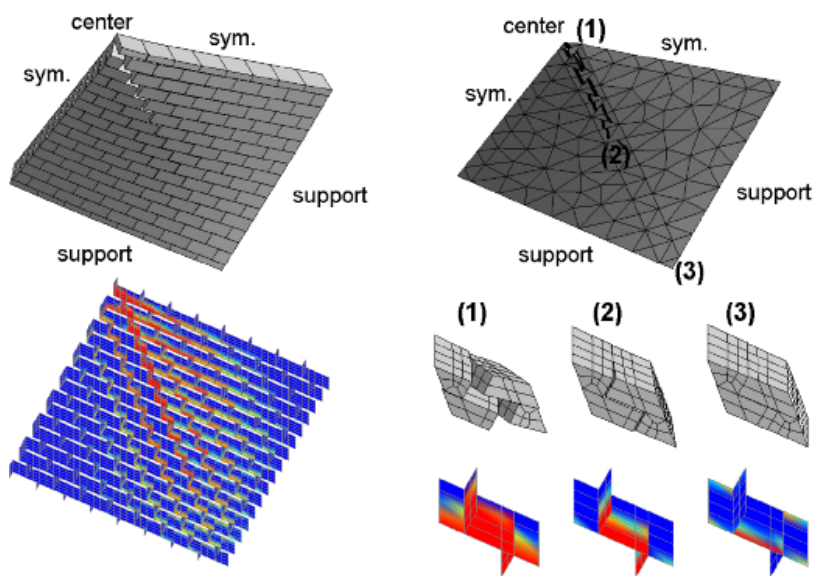
3D RVE

Multiscale modeling of failure in quasi-brittle heterogeneous materials

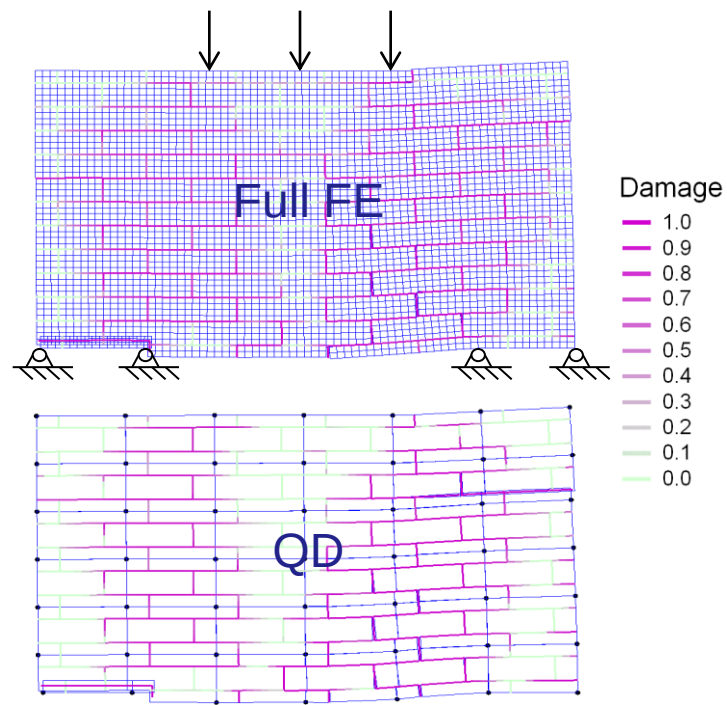
B.C.N. Mercatoris, P.Z. Berke, T.J. Massart

- Shell kinematics
- FE^2 scheme
- Transformation Field Analysis

- Quasi-discrete scheme



Masonry wall out-of-plane loading



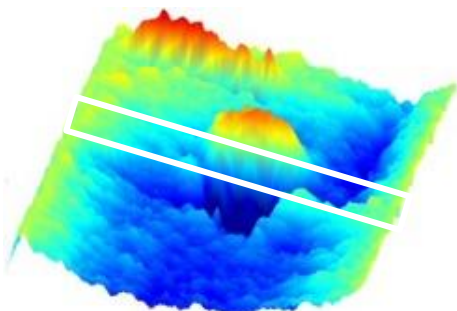
Masonry beam bending simulation

Computational modeling of the surface behavior – computational contact mechanics

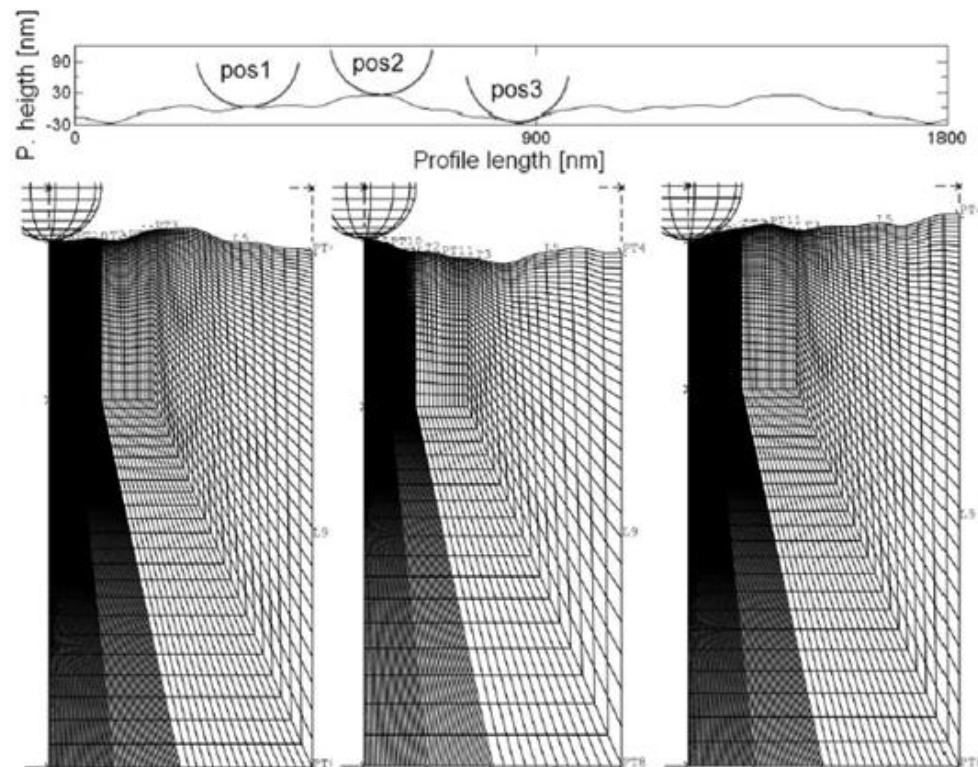
P.Z. Berke, T.J. Massart

Adapting friction by surface modification (roughness, films)
Nanotechnology

Experiments



Surface scan using a nanoindenter tip
E. Tam, 2009





Brussels Faculty of Engineering (Master formation in English)

<http://www.bruface.eu/> (2500€ per year and required proficiency in English)

ULB and Vrije Universiteit Brussel (VUB) collaboration:

Architectural Engineering

Civil Engineering

Chemical and Materials Engineering

Electromechanical Engineering

Electronics and Information Technology

Research (Ph.D.)?

<http://www.cienciasemfronteiras.gov.br/web/csf>

CAPES

CNPq Ciência sem fronteiras program

Possibility of co-tutelle Ph.D. (sandwich)

In and Out mobility on many levels

CNPq – FNRS (Wallon)/FWO (Flemish)

Required proficiency in English

UFOP contact



Prof. Ricardo Azoubel da Mota Silveira



If you are interested, please do not hesitate
to contact us!

ULB is waiting for you with open arms

<http://www.ulb.ac.be/ulb/presentation/uk.html>

