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“Physical bases of the mechanical behavior of materials in pavement structures”

⇒ 3 main topics (materials in Pavement - 3 scales)

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➤ Macro-Micro mechanic and rheological studies of bitumen, asphalt materials and pavement

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➤ Tire pavement contact measurements

Use of Fuji paper (Hamlat et Hagimour, CFM2009)

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➤ Water effect in UGM : contribution to Chapters 8, 9 and 10 Water in Road structures (Geotechnical, Geological, and Earthquake Engineering 5) 2009. Dawson (Ed) Springer.

<http://www.watmove.org/WaterInRoadStructures-Final-Book-Flyer.pdf>

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Study of the Compaction Test - PCG

Granular + Viscous fluid

PE Peyneau PhD (2006-2009) UR Navier (Peyneau, Roux, Physical review E., 2008)

Effect du fluide : lubrification

Numerical simulations

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Rheological properties

USIRF

Viscoanalyse Software (Chailleux, Ramond et al., RMPD 2006) <http://www.lcpc.fr/fr/produits/viscoanalyse/index.dml>

(Huet 1963) (Sayegh, 1965) (Huet, Mechanics and Materials, 31, 1999)

NF EN 12697-26

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ViscoRoute[©] 2.1 research release
ViscoRoute[©] 2.0 (Chabot, Chupin et al., RMPD 2010 in Press)

Introduction of a Complex Poisson ratio
INTRODUCTION OF SLIDING INTERFACES
(Chupin, Chabot, MAIREPAV6 2009) (Chupin, Chabot et al., IJSS 2009 in review)

FUEL CONSUMPTION STUDIES
related to loadings, structure, materials ($\pm T^{\circ}C$)
(Chupin, Piau, Chabot, proposed to ISAP2010)

- elasticity: $\Delta u_z = 0$
- viscoelasticity: $\Delta u_z \neq 0$
- Power dissipation
 $P = V \cdot p \int_{\Omega} u_z \cdot n_x \cdot d\Omega$ (JTR 2005)

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Permanent deformation

→ 3 main topics (materials in Pavement - 3 scales)

- Theoretical and numerical Study of the Compaction Process in a granular material combined with a viscous fluid
(Peyneau PhD thesis, 2009)
(Peyneau, Roux, Physical review E, 2008)
- Experimental Validation of Permanent Deformation modelling for Unbound Granular Materials
(Alou, Chazallon et al., IJ of Num. and Anal.Methods in Geomc. 2007)
(Hornych, Chazallon et al., RMPD2007)
- Rutting studies due to asphalt material
(Nguyen PhD 2006) (Sohm PhD 2007/10)
(Nguyen, Nedjar, Tamagny, RMPD2007)

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Rutting Studies (Visco-plastic problems)
Boundary conditions problems...

Rilem TC-ATB TG3
S. Buisson, V. Dubois, T. Gabet, ...
(Bodin, Grenfell et al., RMPD 2009)

J. Sohm PhD (2007-2010) ENTPE
Triaxial tests on bituminous
(Oillard and Di Benedetto, 2005)

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PREDIT Project 2003/07: DEVIN
INRETS - LMT Cachan - SMIT/LCPC
(Hammou F., Chabot A., Saint-Laurent et al., Materials and Structures 2010, in press)

Rutting problems? (channeling traffic)
Bituminous pavements
Tramway of Clermont-Ferrand (Translohr) - Michelin tires

Champel-Croix de Neyrat intersection

⇒ Effect of horizontal forces with the help of ViscoRoute[©]1.0 Software

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Stress Path in (P,Q) Frame
(Hammou F., Chabot A., Saint-Laurent et al., Materials and Structures 2010, in press)

At the bottom of asphalt layers

Few mm under the surface loaded

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“Physical bases of the mechanical behavior of materials in pavement structures”

3D model of a pavement structure showing stress distributions and field photographs of asphalt pavements.

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Fatigue in Bitumen and Bituminous Materials → 2 TOTAL PhD contracts

Bituminous material (Chkir, 2006-2009)
(Chkir, Bodin et al. Mech. of Time Dep. Mat. 2009)
(Bodin, 2002) → ENDOANALYSE 2D

Bitumen (Le Guern, 2007-2010)
(Chailleux, Bodin et al., Rilem ATCBM2009)

Fracture Toughness prEN
(Chailleux, Mouillet et al., Eurobitume 2008)
CEN TC336/WG1, Draft 4 February 2009

Viscoelastic crack Study
(Nguyen, 2008) ENPC/LCPC
(Hammoum, Chailleux et al., RMPD2009)

Fracture Toughness prEN
(Chailleux et al., ICAP2006)
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Crack and Damage Analysis in Multilayered

(Chabot, Tran , Ehrlicher, Athens2007)
(Pérez, Balay et al., Rilem CP2008) (Chabot, Pouteau et al., Rilem CP2008)

M4-5n, EndoAnalyse Applications
(Chabot, 1997) (Bodin, 2002)

Nu 12
(Spilmann, Master Pro 2007)
(Le Corvec, Master Pro 2008)
(Hun, 2009-2012) New PhD

Biluminous material
Aluminium
Steel material

(Bodin, 2008)

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Water/Freeze Team

(Mauduit et al., RGRA 2007) (Mauduit et al., BLPC 2010)

State of the art -> interface problems

- Collect data from pavements + APT results (Vulcano, Kerzreho et al., ISAP2010)
- Collect data from moisture tests LR Nancy
- First Freeze-Thaw tests

(Mauduit, Hammoum et al., EATA2010)

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Thanks for your attention!

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