**Date and location**
The course is under the auspices of the ISAP TC Constitutive Modeling of Asphaltic Materials and shall be held from 21-25 September 2009 in College Station, Texas at the Campus of the Texas A&M University, USA. Details about the location and nearby hotel arrangements are available at www.insapconmod.nl.

**Language**
All lectures and course handout materials are in English.

**Registration**
The course fee is US$ 900. A special reduced fee of US$ 700 applies for graduate students.

To register, please visit the course link at www.insapconmod.nl or go directly to https://tti.tamu.edu/conferences/amc09/registration.htm

After registration, participants will receive a letter of confirmation, travel and accommodation suggestions. Registration is final after the course fee has been received. The total number of participants is limited, registration will be accepted according to availability.

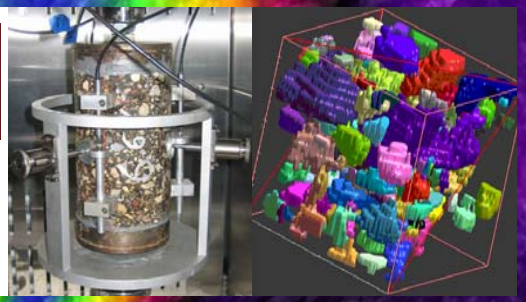
The organizers reserve the right to make necessary amendments to the program. For additional information and course news please refer to: www.insapconmod.nl

ISAP TC Constitutive Modeling of Asphaltic Materials

TEXAS A&M UNIVERSITY

TU Delft

ISAP



TEXAS 21-25 Sept. 2009

International Course Series on
Advanced Constitutive Modeling of
Pavement and Soil Engineering Materials

AN INTENSIVE COURSE ON:

# ADVANCED CONSTITUTIVE MODELING AND CHARACTERIZATION OF ASPHALTIC MATERIALS

An Intensive Course on:

# Advanced Constitutive Modeling and Characterization of Asphaltic Materials

Modern computational techniques, such as the finite element method, demand sophisticated constitutive models for realistic model-based simulations. In modern mechanics literature and in most commercially available finite element software packages, an abundance of constitutive models is encountered. Unfortunately, quite often, the mathematical formulation of these models can be quite forbidding for the uninitiated user. Advanced material models also require state-of-the-art characterization techniques which capture the three-dimensional and multi-scale material response.

The course aims at engineers, scientists, and researchers who want to familiarize themselves with the mathematics, computational methods and characterization techniques associated with constitutive modeling of asphaltic materials. This is of paramount importance for the pavement design community as it moves to mechanistic-empirical and, ultimately, fully mechanistic pavement modeling.

In the course, a team of international experts shall explain the mathematical fundamentals and state-of-the-art material characterization techniques of asphaltic materials. The course includes hands-on laboratory sessions. During the course, participants will also have the opportunity to present and discuss with experts problems of their interest.

## Course organizers:


Texas A&M University, USA:

Eyad Masad
Dallas Little

Delft University of Technology, The Netherlands:

Tom Scarpas
Niki Kringos


## Monday 21 September '09

| | | |
|---|---|---|
| 9:00–09:15 | Welcome and introduction | |
| 9:15–10:00 | Fundamentals of asphalt material behavior | (*Little*) |
| 10:00–10:45 | Calibrated-Mechanistic models* | (*Lytton*) |
| 11:00–12:00 | Vector & matrix notations, introduction to tensors | (*Kringos*) |
| 12:00–13:00 | Lunch | |
| 13:00–13:45 | Descriptions of motion, deformation measures | (*Kringos*) |
| 13:45–14:30 | Polar decomposition, time derivatives* | (*Kringos*) |
| 14:45–15:30 | Mechanical characterization of asphalt mix properties | (*Masad*) |
| 15:30–17:00 | Mechanical characterization laboratory | (*Masad*) |
| 19:00 | Group dinner | |

## Tuesday 22 September '09

| | | |
|---|---|---|
| 9:00– 9:45 | Stress tensors, stress rates | (*Kringos*) |
| 09:45–10:30 | Mechanical balance laws, objectivity* | (*Scarpas*) |
| 10:45–11:30 | Virtual work, Clausius-Planck inequality | (*Scarpas*) |
| 11:30–12:15 | Linearization, directional derivative | (*Scarpas*) |
| 12:15–13:15 | Lunch | |
| 13:15–14:00 | Higher order tensor operations | (*Kringos*) |
| 14:00–14:45 | Surface energy theory and measurements* | (*Bhasin*) |
| 15:00–15:45 | Asphalt healing processes | (*Little*) |
| 15:45–17:00 | Surface energy characterization laboratory | (*Little, Bhasin*) |

## Wednesday 23 September '09

| | | |
|---|---|---|
| 9:00– 9:45 | Hyperelasticity | (*Kringos*) |
| 09:45–10:30 | Introduction to plasticity* | (*Kringos*) |
| 10:45–11:30 | Small strain linear viscoelasticity | (*Masad*) |
| 11:30–12:15 | Applications of linear viscoelasticity | *(Masad)* |
| 12:15–13:15 | Lunch | |
| 13:15–14:00 | Large strain elasto- plastic constitutive modeling | (*Scarpas)* |
| 14:00–14:45 | Analysis and measurements of asphalt mix microstructure* | (*Masad*) |
| 15:00–17:00 | Microstructure characterization laboratory | (*Masad*) |

## Thursday 24 September '09

| | | |
|---|---|---|
| 9:00– 9:45 | Large strain visco-elastic constitutive modeling | (*Scarpas)* |
| 09:45–10:30 | Strong discontinuities constitutive modeling* | (*Scarpas)* |
| 10:45–11:30 | Parameter determination I | (*Kringos)* |
| 11:30–12:15 | Parameter determination II | (*Kringos)* |
| 12:15–13:15 | Lunch | |
| 13:15–14:00 | Introduction to damage mechanics | *(Abu Al-Rub)* |
| 14:00–14:45 | Large strain elasto-plasto-damage constitutive modeling | *(Abu Al-Rub)* |
| 15:00–17:00 | Presentations by course participants | (*All*) |
| 19:00– … | Group dinner | |

## Friday 25 September '09

| | | |
|---|---|---|
| 9:00– 9:45 | Special topics: modeling moisture damage | (*Kringos*) |
| 09:45–10:30 | Special topics: modeling compaction* | (*Masad*) |
| 10:45–11:45 | Presentations by course participants | (*All)* |
| 11:45–11:00 | Lunch and distribution of completion certificates | |

* followed by 15 minute break