ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

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SEMINAR OF NUMERICAL ANALYSIS

- **WEDNESDAY 18 JULY 2012 - ROOM MA A1 10 - 16h15**

Dr. Guillaume Jouvet, (Free Univeristy of Berlin, Germany) will present a seminar entitled:

"Modelling the dynamics of transition zones between grounded ice sheets and floating ice shelves."

Abstract:
For more than one decade, Antarctic ice sheets have been retreating dramatically, and are expected to shrink even more quickly in the future. Recent studies have identifed the migration of the grounding lines separating the grounded part of ice sheets and the floating part of ice shelves as being a key process controlling marine ice sheet stability [4]. It is also wellknown that the grounding line is very sensitive with respect to small climatic perturbations. Over an upward-sloping bedrock, this sensitivity induces fast and irreversible retreats of the grounding line and, then, of the ice sheet [4].
In this talk, we consider a model for the time evolution of ice sheets and ice shelves. First, the slow deformation of ice - which dominates on the grounded part - is described by the the Shallow Ice Approximation (SIA). Second, the fast basal sliding - which dominates on the floating part - is described by the Shallow Shelf Approximation (SSA). At each time step, we have to solve one scalar generalized p-Laplace problem with obstacle and $p > 2$ (SIA) [2] and one vectorial p-Laplace problem with $1 < p < 2$ (SSA) [3]. Both problems can be advantageously rewritten by minimising suitable, convex non-smooth energies. By exploiting such formulations, we implement a truncated non smooth Newton multigrid method [1]. Local non-smoothness are treated by truncation rather than by regularisation which might affect the solution in an arbitrary way. In contrast with most of existing numerical models based on finite differences, our approach allows a wide choice of unstructured meshes to be used and can be easily combined to mesh adaptation techniques. In practice, one needs to refine the mesh in the neighbourhood of the grounding line (transition zone) to capture the high gradients due to the sharp changes in the dynamical regime of ice.
As an illustration, we present numerical results based on the exercises of the Marine Ice Sheet Model Inter-comparison Project (MISMIP).

Lausanne, 22 May, 2011/MP/cr
