ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

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➢ **WEDNESDAY 29 FEBRUARY 2012 - ROOM MA A1 12 - 16h15**

Dr. Aku Seppänen (Univeristy of Eastern Finland, Kuopio /Finland) will present a seminar entitled:

"Reduced order estimation of nonstationnary flows – application to industrial process tomography"

Abstract:
Nonstationary inversion refers to problems in which measurements that are obtained at a time, do not allow for reliable reconstruction of the unknown target. If a feasible stochastic evolution model for the target, however, can be constructed, the reconstruction problem can be recast as a statistical state estimation problem. Fields in which nonstationary inversion that is based on explicit stochastic evolution models has been considered, include biomedicine, hydrology, transport of environmental substances, and, foremost, process tomography. Process tomography refers to a variety of imaging techniques used in process industry. In process tomography, boundary measurements are used to reconstruct the inner properties of the target. These tomographic reconstructions can be used, for example, in process monitoring, control, and design.
In this talk, we specifically consider the simultaneous reconstruction of a nonstationary concentration distribution and the underlying nonstationary flow field. As the observation modality, we employ electrical impedance tomography. Earlier studies have shown that such an estimation scheme is in principle possible since the evolution of an inhomogeneous concentration carries information also on the velocity field. These results have, however, been restricted to either stationary velocity fields or simplified non-physical models. In the general case, the estimation of the velocity field up to the fine details of the flow with diffuse tomography is impossible. In this talk we show, however, that it is possible to estimate a reduced-order representation of a physical fluid dynamics model, here the Navier-Stokes model, simultaneously with the concentration. This is accomplished by considering a proper orthogonal decomposition representation for the velocity field, and careful modelling of the uncertainties of the models, in particular, the subspace of the velocity field that is not estimated.

Lausanne, 6 January 2012 / MP/cr
