CENTRO DE INVESTIGACIÓN Y DE ESTUDIOS AVANZADOS DEL IPN

El ***Departamento de Control Automático***

invita cordialmente a su

Seminario Departamental

Modeling and Identification of Trace Gas History in Environmental Sciences

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Abstract: Models of trace gas (e.g. ozone-depleting substances or green house gases) transport in polar firn are used to relate firn air and ice core records of trace gases to their atmospheric history. Such modeling can be decomposed into three steps: 1) a physical (forward) transport model describes the gas behavior in the ice lattice; 2) the depth profile of firn diffusivity is identified from measured gases in the firn with known atmospheric history; 3) the atmospheric history is reconstructed for gases for which only measurements in firn air are available. Recent developments of these aspects in LGGE-GIPSA models will be presented, with a focus on the link between physical processes and issues in their mathematical solving. The main mathematical difficulties arise from the firn diffusivity values, which vary by several orders of magnitude in a model described by partial differential equations, and from inverse modeling using sparse measurements (under-constrained inverse problems). Using methodological contributions from system identification and control theory, we present new results on: 1) the development of a gradient descent method for optimal diffusivity identification; 2) a forward isotopic ratio model (linear time-varying) that does not require assumptions on the major isotope trend; 3) a new inverse scenario method for isotopes based on 2).

Biography: Emmanuel Witrant obtained a B.Sc. in Aerospace Engineering from Georgia Institute of Technology in 2001 and a Ph.D. in Automatic Control from Grenoble University in 2005. He joined University Joseph Fourier and GIPSA-lab as an Associate Professor in 2007. His research interest is focused on the modeling and control of inhomogeneous transport phenomena (information, energy, gases...), with real-time and optimization constraints. The resulting methods provide new results for controlled thermonuclear fusion, environmental sciences and Poiseuille's flows. http://www.gipsa-lab.grenoble-inp.fr/~e.witrant/