Séminaires du LAAS-CNRS

Laboratoire d'Analyse et d'Architecture des Systèmes du CNRS

DISTRIBUTED DISSIPATIVE SYSTEMS

par

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Jeudi 19 octobre 2006 à 14 h 30

LAAS-CNRS - Salle Europe

Ce séminaire se déroulera en anglais.

Pôle MOCOSY

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résumé de l'exposé

Objet du séminaire : Systèmes dissipatifs distribués

Dans le cadre de la théorie comportementale, on introduit la classe des systèmes passifs décrits par des EDP linéaires et des taux d'entrée quadratiques en les variables du système et leurs dérivées partielles. La construction du stockage et du flux se ramène à la factorisation de polynômes multivariés matriciels.

The notion of a dissipative dynamical system was introduced in the early 1970's. It generalizes the idea of a Lyapunov function to 'open' dynamical systems. This concept has found applications in diverse areas of systems and control, for example, in stability theory, system norm estimation, and robust control. A central problem that emerges is the construction of a storage function. It is this problem that brought LMI's to the foreground.

The main topic of this talk is distributed dissipative systems. First sorne basic system theoretic concepts for systems described by linear constant co¬efficient PDE's are discussed, within the behavioral framework. Issues as sub-module characterizations, elimination, and controllability and observ¬ability are introduced.

Subsequently, dissipative systems described by linear PDE's and supply rates that are quadratic expressions in the system variables and their partial derivatives are defined. The dissipation inequality for such systems involves, in addition to the storage function, also the flux. The construction of the storage and the flux reduces to the factorization of polynomial matrices in many variables. This leads straight to Hilbert's 17-th problem regarding the sum-of-squares representation of nonnegative polynomials in many variables. Throughout the talk, Maxwell's equations will be used as the paradigmatic example.

l'orateur

Jan C. Willems was born in Bruges in Flanders, Belgium. He studied engineering at the University of Gent. After graduation in 1963, he went to the US, and obtained the Ph.D. degree in electrical engineering from the Massachusetts Institute of Technology in 1968. He was an assistant professor in the department of electrical engineering at MIT from 1968 to 1973.

On February 1, 1973, he was appointed Professor of Systems and Control in the Math¬ematics department of the University of Groningen. Since 2003, he is a full-time Guest Professor at the department of electrical engineering, with the research group on Signals, Identification, System Theory and Automation (SISTA), at the K.U. Leu¬ven, Belgium.

His research interests are in various aspects of Systems and Control Theory, especially stability theory and the development of the behavioral approach.