Plenary Lecture

Generalized Differential-Difference Equations to Economic Dynamics and Control

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Abstract: Dynamic economic models generally consists in difference or differential behavioral equations. Several arguments are in favor of continuous time systems: the multiplicity of decisions overlapping in time, a more adequate formulation of market adjustments and distributed lag processes, the properties of estimators, etc. The type of dynamic equations also refer to historical and practical reasons. In some cases of the economic dynamics, mixed differential-difference equations (DDEs) may be more suitable to a wide range of economic models. The dynamics of the early Kalecki's macroeconomic model is represented by a linear first-order DDE with constant coefficients, in the capital stock. Such a DDE, with constant or flexible lags, also occurs in the continuous time Solow's vintage capital growth model. This is due to the heterogeneity of goods and assets. In some qualitative study, the time delay is replaced by the Taylor series for a sufficiently small delay and a not too large higher-order derivative. DDEs with constant lags may be preferably solved using Laplace transforms. Numerous techniques are also proposed for the solutions of DDEs, like the inverse scattering method, the Jacobian elliptic function method, numerical techniques, the differential transform method, etc. This study introduces the block diagram approach with application to reference economic models, with help of the powerful software *MATHEMATICA* 6.0. Specialized *MATHEMATICA* packages for signal processing are used for analyzing and solving, symbolically and numerically, the continuous and discrete systems, such as with "Control System Professional", "Polynomial Control Systems" and "SchematicSolver".

Brief Biography of the Speaker: At present, Professor André A. Keller (66) is an associate researcher in mathematical economics with application to environment problems and related modeling techniques at the CLERSÉ a research unit of the French CNRS at the University Lille 1 for Sciences and Technologies. Prof. Keller received his PhD in Economics (Operations Research) in 1977 from the Université de Paris. He taught applied mathematics (linear and nonlinear optimization techniques) and econometrics, microeconomics, theory of games and dynamic macroeconomic analysis. Since 1970, he has been chief econometrician at the Centre d'Observation Economique of the Chamber of Commerce & Industry of Paris. His experience includes macroeconomic, regional studies and commercial statistics: building econometric systems for short run analysis, analyzing policy impacts and forecasting, monthly time-series treatments. At the same time, he contributed to teaching microeconomics with the Université de Paris. Since 1980, he has been Associate Professor at the Université de Paris and Researcher in a research unit of the Centre National de la Recherche Scientifique. His experience centers are on building and analyzing large scale macro-econometric models, as well as forecasting. Since 1985, his research interest has concentrated on high frequency time-series modeling with application to the foreign exchange market : spectral properties of usual filters, automatic selection of ARIMA models, efficiency tests. Since 1990, Prof. Keller's research is centered on discrete mathematics (graph theory), stochastic differential games and tournaments, circuit theory of systems, dynamics and optimal control in economic modeling under uncertainties and in

a fuzzy environment. Prof. André A. Keller's publications consist in writing articles and co-authoring books. The articles in scientific reviews are on model building with application to macroeconomics and international finance. The books chapters are on semi-reduced forms of econometric models (Martinus Nijhoff, 1984), econometrics of technical change (Springer and IIASA, 1989), advanced time-series analysis (Woodhead- Faulkner), circuit enumeration (Springer, 2008), stochastic differential games (Nova Science, 2009), optimal fuzzy control (InTech, 2009), circuit analysis (Nova Science, 2009).