February 13, Tuesday (Colloquium Talk)
Time : 14:30 – 15:30
Place: Science 103
Koç University, Rumelifeneri Yolu, Sariyer, Istanbul

Title:
Energy based modeling, simulation and control of energy systems

Abstract:
Most real world dynamical systems consist of subsystems from different physical domains, modelled by partial-differential equations, ordinary differential equations, and algebraic equations, combined with input and output connections. To deal with such complex system, in recent years energy based modeling via the class of dissipative port-Hamiltonian (pH) descriptor systems has emerged as a very successful mathematical modeling methodology. The main reasons are that the network based interconnection of pH systems is again pH, Galerkin projection in PDE discretization and model reduction preserve the pH structure and the physical properties are encoded in the geometric properties of the flow as well as the algebraic properties of the equations. Furthermore, dissipative pH systems form a very robust representation under structured perturbations and directly indicate Lyapunov functions for stability analysis. Another advantage of energy based modeling via pH systems is that each separate model of a physical system can be a whole model catalog from which models can be chosen in an adaptive way within simulation and optimization methods. We discuss the model class of constrained pH systems and show how many classical real world mathematical models in energy systems can be formulated in this class. We illustrate the results with some real world examples from gas transport, district heating and power systems and point out emerging mathematical challenges.

February 15, Thursday (Mathematics Seminar Talk)
Time : 14:30 – 15:30
Place: Science 103
Koç University, Rumelifeneri Yolu, Sariyer, Istanbul

Title:
Hypocoercivity, hypocontractivity and short-time decay of solutions to linear evolution equations

Abstract:
For linear evolution equations (in continuous-time and discrete-time) we revisit and extend the concepts of hypocoercivity and hypocontractivity and give a detailed analysis of the relations of these concepts to (asymptotic) stability, as well as (semi-)dissipativity and (semi-)contractivity, respectively. On the basis of these results, the short-time decay behavior of the norm of the fundamental solution matrix for linear continuous-time and discrete-time systems is characterized by an integer called hypocoercivity index or hypocontractivity index, respectively. The results extend to linear operators in Hilbert spaces and can be applied to the analysis of anisotropic flows.