



Revealing structure in large MIMO-LTI systems using a network approach

Rolf Hut and Nick van de Giesen

Delft University of Technology, Faculty of Civil Engineering and Geoscience, Delft, Netherlands (r.w.hut@tudelft.nl)

Identification of system properties in large multiple input, multiple output systems (MIMO) is currently mostly done by using a black box approach, or by using a priori knowledge of the (physical) system. However, by viewing the system from a network point of view, it is possible for linear, time-invariant (LTI) systems, to recalculate the overall relations between input and output into a network of connected single input single output systems. Using this network framework it is easy to identify feedbacks within the system, which is impossible in a black box system. Furthermore, it is possible to relate identified relations between parts of the system more easily to their physical representations, without having to make a priori assumptions on those physics. The combined model order of these connected systems will be at most equal to the order of the MIMO system and usually lower. Applications of the network system/approach are foreseen in diverse fields such as hydrological forecasting, climate modeling and economics, among others. The network approach can be used in a “forward” mode to calculate total system response from a known network of interacting system, such as rainfall-runoff modeling in a catchment divided in sub-catchments.