"Industrial mathematics" seminar

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The Jacobian of metabolic networks:
a key for (in)stability, bifurcations and control

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Metabolism is central to life. In this talk I address dynamical systems arising from metabolic networks. Notoriously, the Jacobian matrix is a central tool for the stability analysis of the equilibria. In particular, a change of sign of the Jacobian determinant may indicate loss of stability and bifurcations. We show here how this sign question, which have striking consequences for the dynamics, can be discussed based only on the network structure. In our approach, the Jacobian determinant reads as a homogenous multilinear polynomial, where the sign of each coefficient depends on certain subnetworks. In particular we identify 'good' subnetwork patterns, which do not affect the sign of the determinant, and 'bad' subnetwork patterns which are responsible for sign changes, instability, and bifurcations.

Everyone is welcome!