Port-Hamiltonian systems and boundary triplets

H. Zwart

Port-Hamiltonian systems have been introduced in systems theory. When a port-Hamiltonian system has is no interaction with its environment, then it has a conserved quantity, known as the Hamiltonian. Typical examples are hyperbolic partial differential equations, like the vibrating string. When there is an interaction with the environment, then the change of the Hamiltonian is determined by a (power) flow through the boundary.

Boundary triplets are normally used for parabolic partial differential equations, such as the diffusion equation. Central for boundary triplets is the (generalized) Greens identity.

Hence the class of partial differential equations for these topics is different. Furthermore, in port-Hamiltonian systems, the time places an important role, whereas this is totally absent in the theory of boundary triplets.

Despite all these differences, we show we can identity a common underlying structure, known as a Dirac structure for port-Hamiltonian systems, and as a hyper-maximal neutral subspace in Kreĭn spaces. This implies that results in one field carry over to the other field. However, since these fields have developed independently of each other, similar results and concepts were introduced, but under different names. We will clarify the links between both fields. Special emphasis will be laid on the interconnection of port-Hamiltonian systems and thus of boundary triplet.

As may be concluded from the above summary, the talk will have a strong tutorial nature.