

# SYMMETRIC SPACES AND LIE TRIPLE SYSTEMS IN NUMERICAL ANALYSIS OF DIFFERENTIAL EQUATIONS

ANTONELLA ZANNA MUNTHE-KAAS

A remarkable number of different numerical algorithms can be understood and analyzed using the concepts of symmetric spaces and Lie triple systems, which are well known in differential geometry from the study of spaces of constant curvature and their tangents. This theory can be used to unify a range of different topics, such as polar-type matrix decompositions, splitting methods for computation of the matrix exponential, composition of selfadjoint numerical integrators and dynamical systems with symmetries and reversing symmetries. The thread of this talk is the following: involutive automorphisms on groups induce a factorization at a group level, and a splitting at the algebra level. We will give an introduction to the mathematical theory behind these constructions, and review recent results. Furthermore, we present a new Yoshida-like technique, for self-adjoint numerical schemes, that allows to increase the order of preservation of symmetries by two units. Since all the time-steps are positive, the technique is particularly suited to stiff problems, where a negative time-step can cause instabilities.

DEPARTMENT OF MATHEMATICS, UNIVERSITY OF BERGEN, NORWAY