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Multi-complex numbers and spinors

Spinors are crucial and ubiquitous in both mathematics and physics, but they are less intuitive than rotations - despite the fact that spinors "merely" define an irreducible representation for the rotation (or spin) group. In this lecture we will try to explain where spinors really come from, and what they are trying to express geometrically. To do that, we will start from the Cartan-Dieudonné theorem (which factorises a rotation in terms of reflections) in the setting of geometric algebras (also known as Clifford algebras). Using simple multiplication rules in this algebra, which we will also derive from the geometry itself, we will then see how spinors spontaneously emerge as certain multivectors in this algebra. We will then proceed with noting that there are pure spinors, which have a nice and geometric interpretation, but in dimensions $m \geq 8$ one gets impure spinors as well. These are very interesting, leading to for instance models in the geometric algebra for exotic number systems such as the octonions and sedenions, but less intuitive. We will explain the connection with multi-complex numbers, and if time permits also show how these exotic structures are embedded.