Algebra 2 (2013)-Aalborg University
Lecture 9, March 5th

9th Lecture (C): Tuesday March 5th, 8:15–12:00. I will not be present during this lecture, it is self-study.

We will study an application of the ring of quaternions (Example 3.1.2 in [Lau]) in this lecture. We will use the book: [Van] J. Van Verth, L.M. Bishop: "Essential mathematics for games and interactive applications: a programmer's guide". Second edition. Morgan Kaufman. ISBN: 0123742978; ISBN: 9780123742971. This book is on-line available through AaU library: AUB link or Dawsonera link

Objects in a 3D game, such as an airplane or a person, are represented in the real 3-dimensional affine space. Besides the position of the object, an orientation is also needed, one should represent in which direction a person is looking or what the direction of an airplane is. Furthermore, one also needs to rotate the objects (change direction) when there is a movement.

When representing orientation/rotation, one wants to use a small number of values and to concatenate several orientations/rotations in order to form a new orientation/roation in an efficient way. There are several ways of representing the orientation/rotation (Chapter 5 in [Van]) but the most efficient one makes use of quaternions (Section 5.5).

Moreover, when creating an animation, one should interpolate the movement since an object can move in one direction while its orientation changes. Quaternions are also used in this setting (Section 10.3).

Note that the book is written by and for engineers and does not use the language of rings for quaternions, they are described in an elementary way. However, we can understand all the computations with this algebraic structure.

The applications of quaternions can be found in Section 5.5 (Pages 185–201) and Section 10.3 (Pages 458–468). However, it is also recommended that you read Section 5.4 and the introduction to Chapters 5 and 10 in advance.

Best regards,

Diego