



Pose Interpolation with Dual Quaternion Series

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Intermediate Presentation



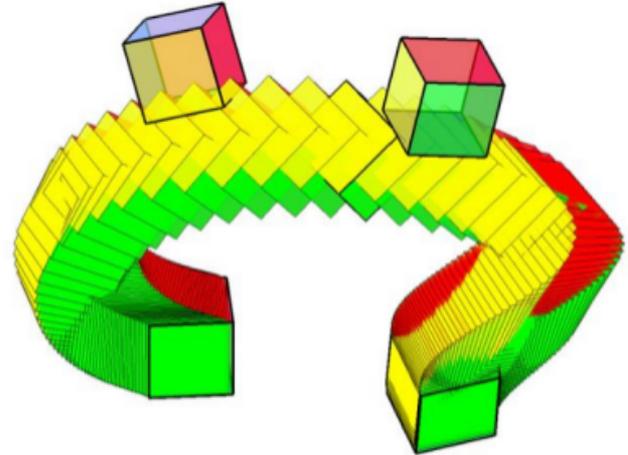
Technische Universität München



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Goal of the project

- Implement algorithm for smooth interpolation of pose (rotation and translation) using dual quaternions



Interpolation based on four measurements [1]

[1] Documentation – Kinematic toolbox, Daniel Klawitter, Technische Universität Dresden, March 29, 2010



Background and Motivation

- Real-time tracking systems benefits from interpolation
 - animation
 - multi-modal sensor
- Quaternions
 - robust
 - fast
 - efficient
- Dual quaternion for rigid-body motions



Existing solutions

- Linear interpolation of Euler angles or rotation matrices

- Quaternions:

- Linear interpolation
- SLERP

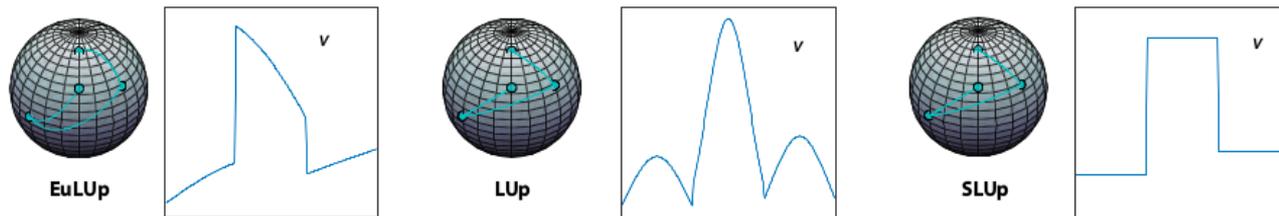


Figure 1. Resulting axis angle rotations of the upsampling methods EuLUp, LUp, SLUp and their angular velocity v .

- Dual quaternions:

- Screw linear upsampling
- Dual quaternion linear upsampling

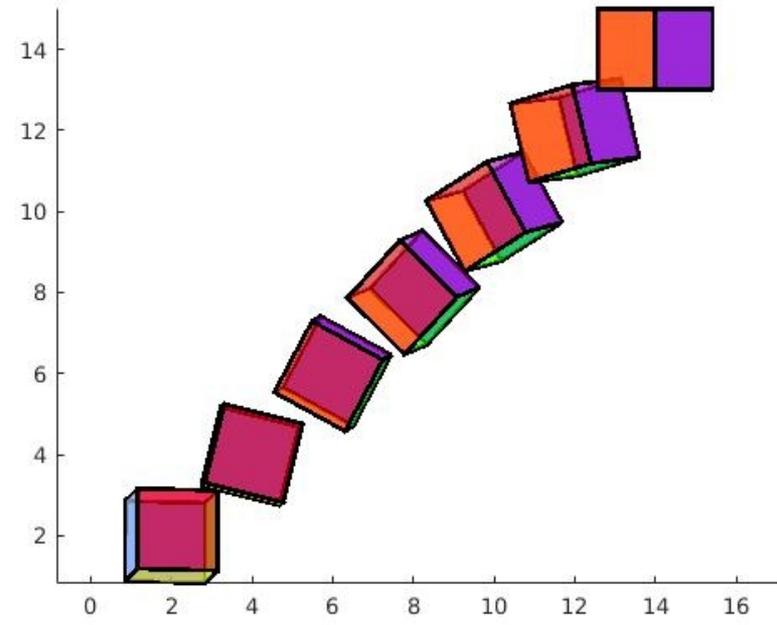
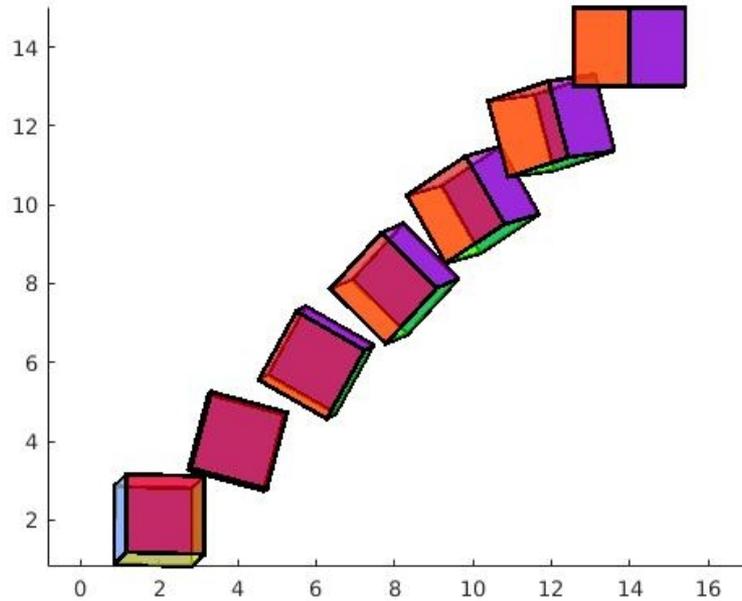
[2] Quaternionic Upsampling: Hyperspherical Techniques for 6 DoF Pose Tracking, Benjamin Busam, Marco Esposito, Benjamin Frisch, Nassir Navab, 3DV, 2016



Existing solutions. Examples

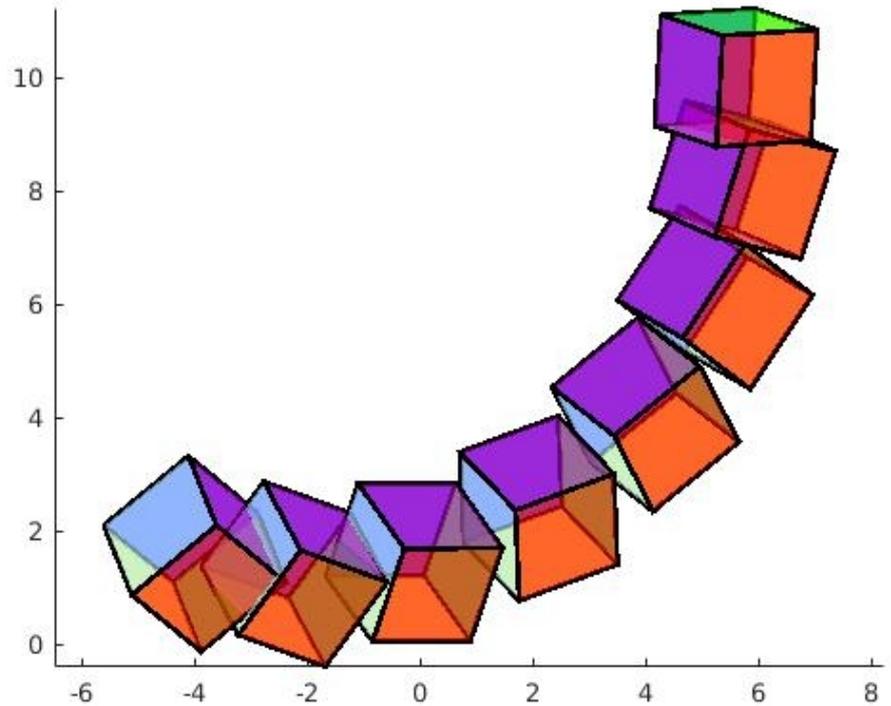
Spherical linear interpolation VS

Linear interpolation



Existing solutions. Examples

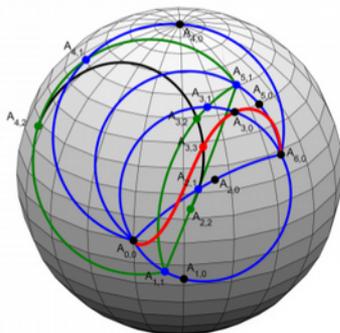
- Linear interpolation for dual quaternions



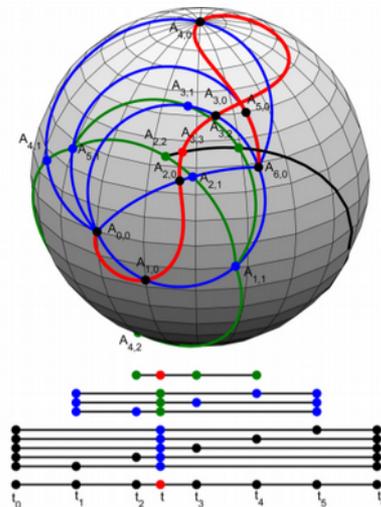
Methods and materials

- Cumulative basis [3]:
 - Bezier curve
 - Quadric Bezier curves (QB) [1]
 - Hermite curves
 - B-spline curves
- Aitken [1]

$$p(t) = \sum_{i=0}^n p_i B_i(t)$$



QB curve construction [1]



Extended Aitken algorithm [1]

[3] A General Construction Scheme for Unit Quaternion Curves with Simple High Order Derivatives - Myoung-Jun Kim, Myung-Soo Kim, Sung Yong Shin (1995)

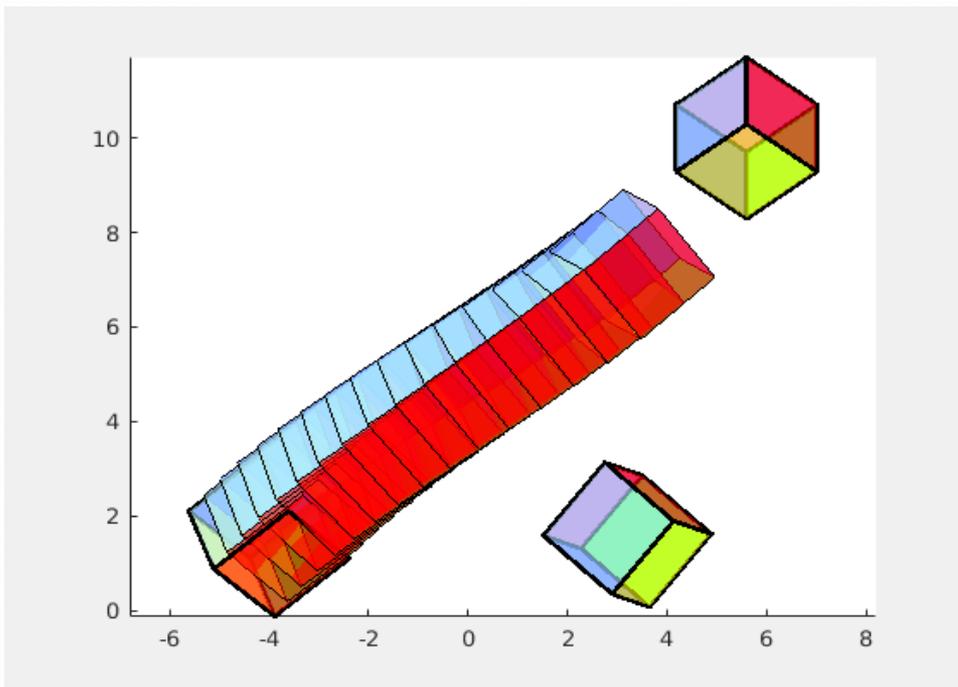
[1] Documentation – Kinematic toolbox, Daniel Klawitter, Technische Universität Dresden, March 29, 2010



Experiments. Aitken interpolation

51 poses,
based on 3 measurements

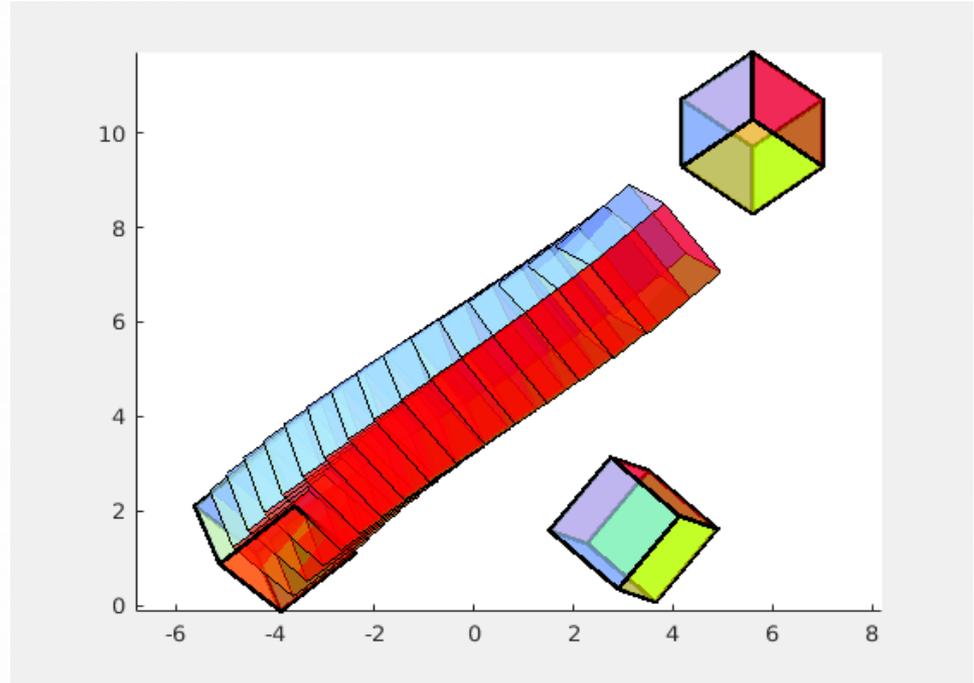
0,028 sec



Experiments. QB interpolation

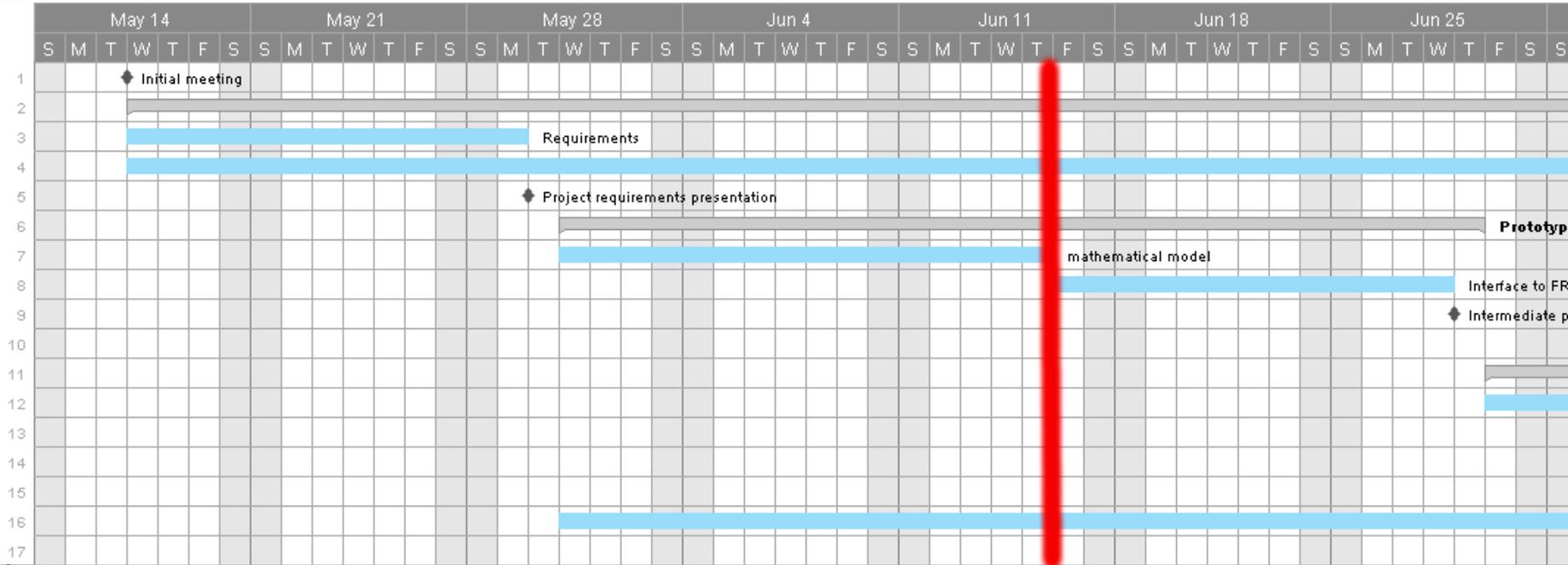
51 poses,
based on 3 measurements

0,006 sec



Work Packages and Milestones

Gantt Chart [4]

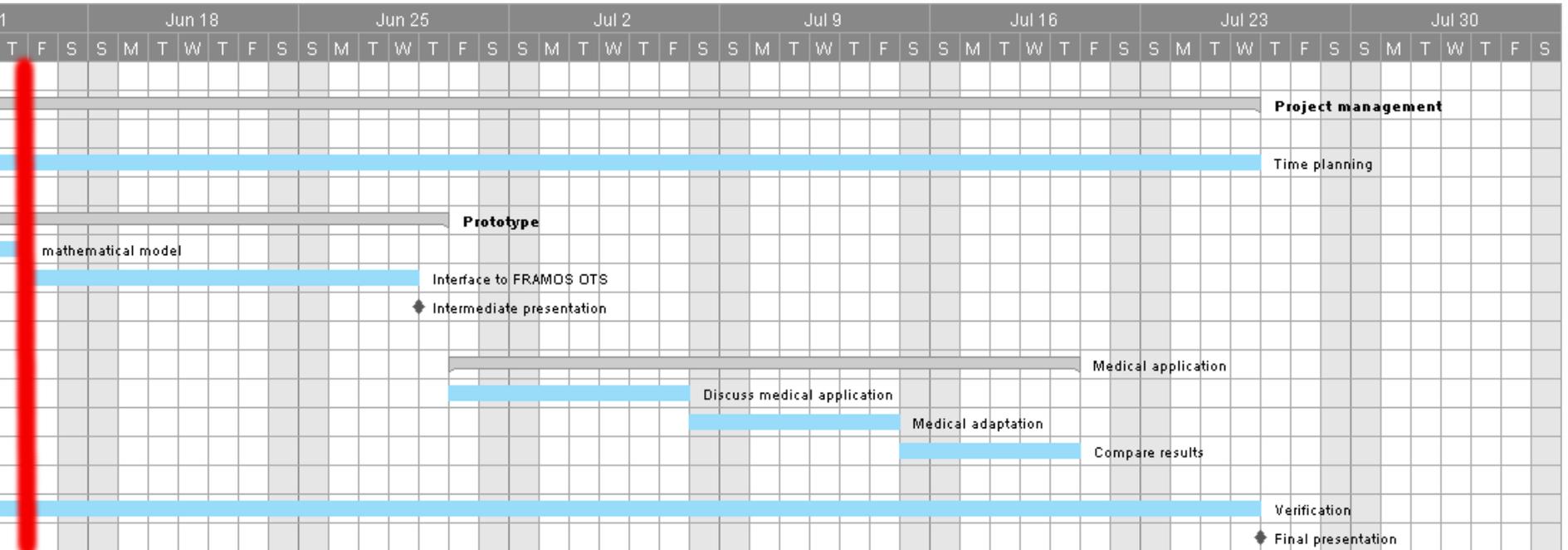


[4] Created by smartsheets.com



Work Packages and Milestones

Gantt Chart [4]



[4] Created by smartsheets.com



Project risks

- Schedule risks
 - incorrect time management
 - lack of time
- Technical risks
 - integration with external system
 - not real-time performance



Activity Diagram

