Forward Kinematics

2021.4.13

Outline

- Demo
- Project overview
- Scoring criteria
- Objective and explanation
- Submission detail
- Hint and reminder

Demo

- Forward Kinematics

Demo (cont.)

- Time Warping

Before time warping

After time warping

Project overview

- Solution layout
  - bin
  - assets
    - Shader and Texture
    - Acclaim - skeleton (asf) and motion (amc) files
    - Fonts - icon fonts
  - src (source code)
  - include (header files for src)
  - extern (project dependencies)
  - ForwardKinematics (Visual Studio project and main)

Project overview (cont.)

- Environment
  - IDE: Visual studio 2017 / 2019
  - Platform: Windows

  - Graphics API: OpenGL
  - OpenGL Loading Library: glad2
  - OpenGL Toolkit: glfw
  - UI Library: dear imgui

  - Math Library: Eigen

Project overview (cont.)

- src
  - acclaim (code for parsing acclaim files)
  - grahpics (code for rendering geometries)
  - simulation (code for running simulation)
  - util (utilities)

- Everything you need to implement is in the simulation folder

Scoring Criteria

- Forward kinematics - 50%
- Time warping - 30%
- Report - 20%
- Bonus - up to 15%

Objective and explanation

- forwardSolver(posture, bone)
  - Convert motion data from joint space to the Cartesian space
- timeWarper(vector of posture, old keyframe, new keyframe)
  - Modify the given motion sequences with arbitrary profile

Objective and explanation (cont.)

- Report (below is a suggested outline)
  - Introduction/Motivation
  - Fundamentals
    - Describe local and global coordinates in your words
  - Implementation
  - Result and Discussion
  - Conclusion

Submission detail

- Compress required files into a .zip file
  - Naming rule: CA2_StudentID.zip
    - e.g., CA2_309553010.zip

- Your zip file should contain following components
  - simulation/kinematics.cpp
  - Report in **PDF** format, no more than 10 pages

Submission detail (cont.)

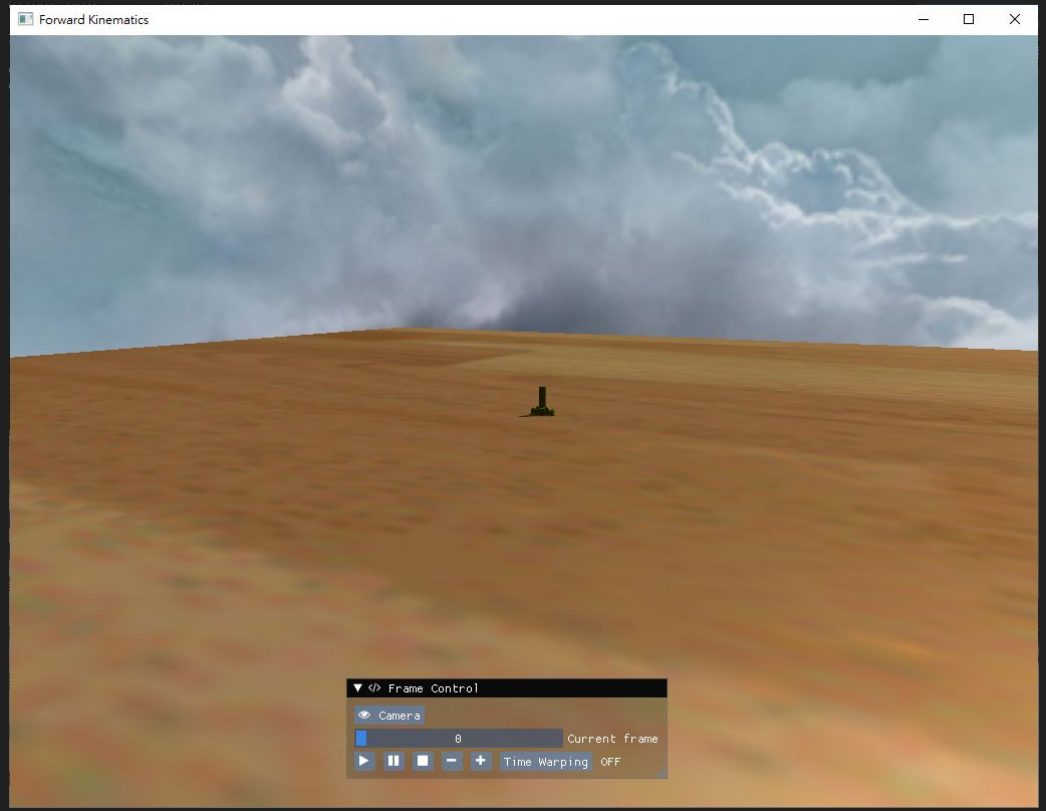
- Upload all your materials to new E3
  - No limit to the number of times of upload
  - The latest version is your final submission

Submission detail (cont.)

- Late policies
  - Penalty of 10 points on each day after deadline
- Cheating policies
  - 0 points for any cheating on assignments
  - Allowing another student to examine your code is also considered as cheating
- Deadline
  - Monday, 2021/05/03, 23:55

Hint and Reminder

- Blank template:



Hint and Reminder (cont.)

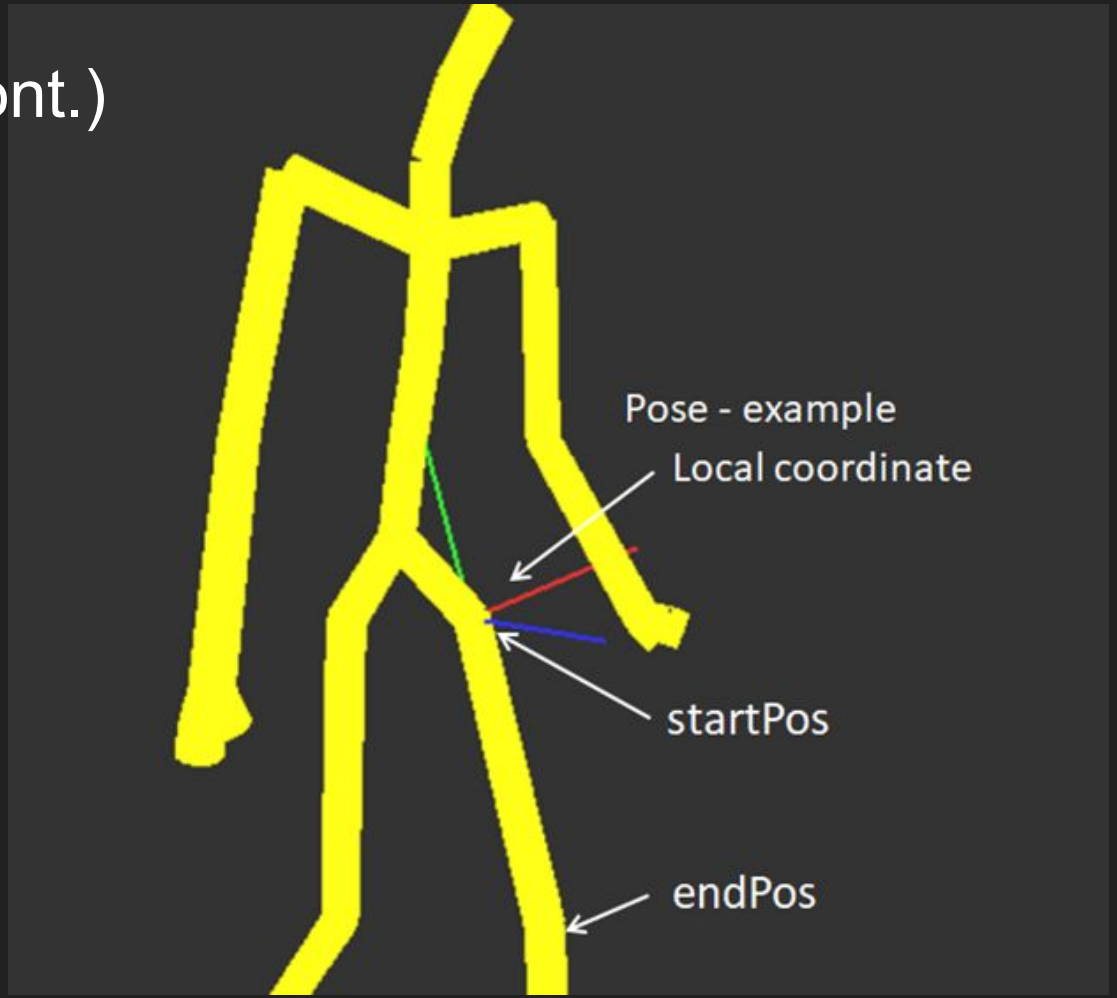
- Eigen Library - Quick reference
  - Eigen::Vector4d (SIMD friendly)
    - We use 4D vector to represent 3D vector, so keep last dimension (3) = 0
    - You should use cross3() instead of cross()
    - 4d means 4D vector with double as internal type
  - Eigen::Affine3d - Affine transform
    - How to use?
  - Eigen::Quaterniond - Quaternion
    - Has an useful slerp() member function

Hint and Reminder (cont.)

- namespace util
  - rotate{Degree|Radian}{XYZ|ZYX}
  - e.g. rotateDegreeXYZ(x, y, z) means:
    - x, y, z are present in degree
    - rotate z degrees along z-axis first, then y degrees along y-axis, then x degrees along x-axis

Hint and Reminder (cont.)

- Pose example
- Each bone has
  - local coordinate
  - start position
  - end position

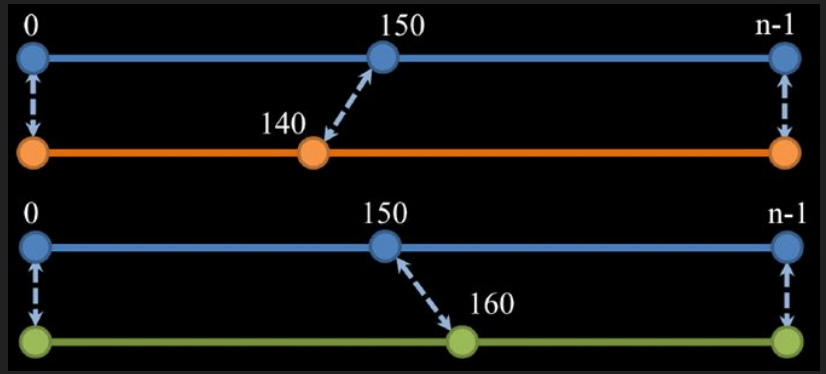


Hint and Reminder (cont.)

- forwardSolver:
  - You have to set each bone’s global start and end position and rotation
    - Read local coordinate data from posture first
  - Hint: Maybe you can use DFS or BFS to traverse all bones

Hint and Reminder (cont.)

- timeWarper:
  - You have to implement time warpping
    - If your implement is correct then the skeleton can catch the ball
  - Perform interpolation
    - Linear interpolation on translation
    - Spherical linear interpolation on rotation



Hint and Reminder (cont.)

- How to properly report bonus?
  - Mention it in your report.
  - If your implementation violates with the original implementation, please make a toggle for switching.
  - If your bonus hides any original feature, you will get not get the score for the features that the TAs cannot test.

Hint and Reminder (cont.)

- How to contact TA?
  - Please ask your question on new E3 forum.
    - or send email to **BOTH** TAs via new E3 if the question is personal.
  - If you need to ask question face-to-face, please send email for appointment.

  - IMPORTANT: please sort out and arrange your question, so we can help you without wasting time on trivial matters.