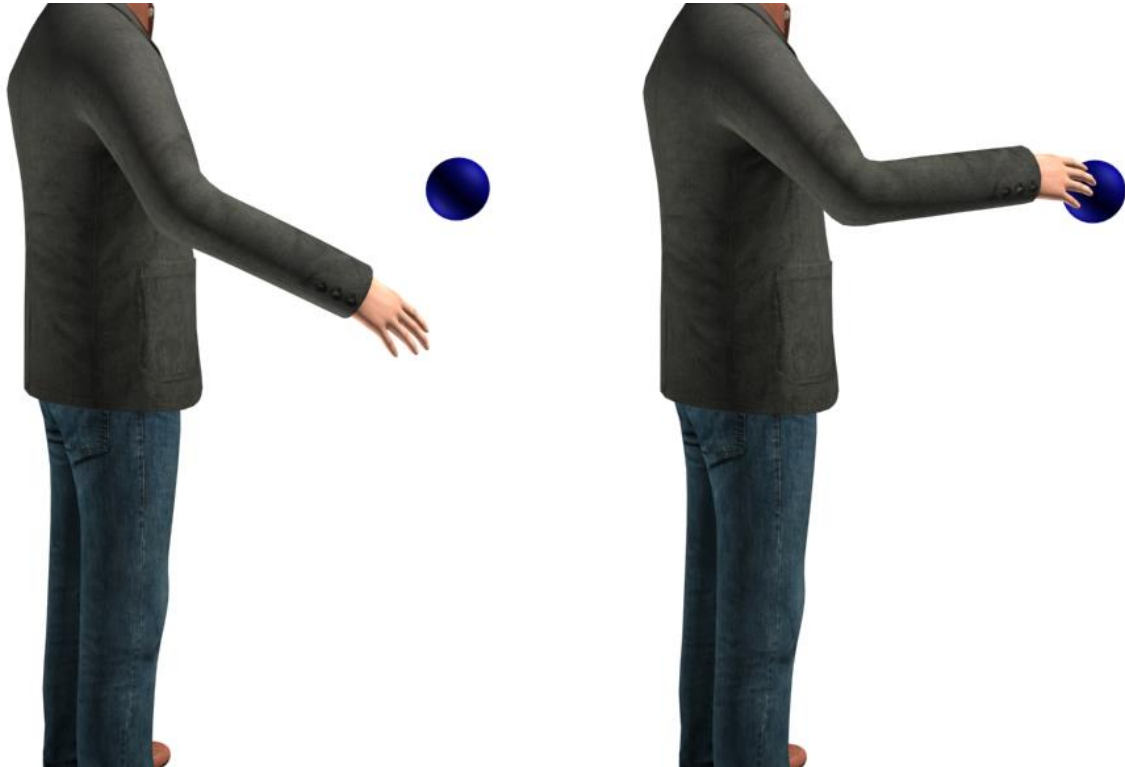


Assignment #02: Arm Inverse Kinematics

Due Date: 3rd March 2021

Coursework %: approximately 20%

The purpose of this lab is for you to learn how Inverse Kinematics works in practice.



The goal of inverse kinematics is to compute the vector of joint DOFs that will cause the end effector to reach some desired goal state.

1. This assignment is strictly **individual** (no groupwork).
2. You are required to create an arm and torso, where the arm should be constructed from a lower and upper arm, and attached to the torso. Your application must work out appropriate orientations for the lower and upper arm, given the desired position of the end effector (hand).
3. Analytical solutions to IK are the most straightforward and can be used for 2 links only (upper and lower arm). If you wish to extend to more complex chains, other approaches (CCD, Jacobian) should be investigated.
4. A 3DS Max character model is provided on Blackboard if you want to use it. Please note that this character is property of GV2 and cannot be used outside of this project. You are not required to use a skinned model and can go for basic shapes if you wish. There are many resources online also for downloading free character models: turbosquid, mixamo, etc.
5. You will be required to **show your working** program to the demonstrator online on the due date and they will grade you based on what you show them. Please note that since the course is based on continuous assessment, this is considered an examination and you are required to attend.

6. You will also be required to submit your **report and code** on Blackboard by the due date. Submissions must be on Blackboard as we will not be accepting submissions via email. Your submission should include a **pdf report with a short written description and screen shots, along with the accompanying zipped code (cpp and h files used)**. Please submit report and code as separate files, and do not submit the entire Visual Studio project. If you fail to show up for the online lab or to submit your report on time, you will be reported as absent and will receive a grade of 0%.
7. Do not wait until the last minute to start this assignment. This assignment is **difficult** and will require some time to get the concepts and implementation correct. Be sure to attend labs and ask the demonstrator for help via the discussion board.
8. Be aware that demonstrating a project that was not created by you is considered **cheating** and will be reported as such. The demonstrator will check if you have an understanding of the code that you have written.

Requirements and Examination

Your application should have the following features:

- 3D Inverse Kinematics to compute the joint angles of the upper and lower arm of a simple humanoid character (~50%)
 - You will be asked to demonstrate both reachable and unreachable positions.
 - You can use an analytical solution, CCD, or FABRIK
- Extra Features (~50%)
 - More complex chains (e.g., 3D IK of full finger-tip to shoulder appendage using CCD)
 - Complex inverse kinematics algorithms (e.g., Jacobian)
 - Scripted animation for the end effector (e.g., using splines, ease-in ease-out curves)
 - **Visual appearance of the model (e.g., skinned model)**
 - Added constraints for natural human movements (e.g., elbow cannot extend beyond natural limits)
 - etc.

Note: The [approximate] marking scheme provided shows the maximum marks that can be obtained for each section if completed perfectly. Merely attempting a section does not imply the full score indicated.