

15-464/15-664 Reference List for January 30

I began by pointing out useful references for CCD with some simple examples and code:

Lander, Jeff. "Oh my god, I inverted kine." *Game Developer Magazine* 9 (1998): 9-14.
http://www.cs.cmu.edu/~15464-s13/lectures/lecture6/jlander_gamedev_sept98.pdf

Lander, Jeff. "Making kine more flexible." *Game Developer Magazine* 1, no. 15-22 (1998): 2.
http://graphics.cs.cmu.edu/nsp/course/15464-s15/www/lectures/lec06/jlander_gamedev_nov98.pdf

We then dug into the following paper, talking about the use of projection into the nullspace to “push” the character towards a rest pose, or in this case, back towards pin constraints placed by the user. This paper uses the Jacobian damped pseudoinverse with nullspace projection to do character posing with a two-level priority system. The point which the user clicks and drags is given top priority as the IK target, and secondary constraints include satisfying constraint points, moving the character towards a reference pose, and resolving joint limits.

Yamane, Katsu, and Yoshihiko Nakamura. "Natural motion animation through constraining and deconstraining at will." *Visualization and Computer Graphics, IEEE Transactions on* 9, no. 3 (2003): 352-360. http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=1207443

I also showed the brief video for the following paper, which talks about how to parallelize conventional Jacobian based IK for better, quicker solutions.

Harish P, Mahmudi M, Callennec BL, Boulic R. Parallel inverse kinematics for multithreaded architectures. *ACM Transactions on Graphics (TOG)*. 2016 May 25;35(2):19.
<http://dl.acm.org/citation.cfm?id=2887740>

We then talked for a bit about the gradient based view of inverse kinematics, deriving the result that minimizing squared distance to the target looks like the Jacobian transpose approach to IK. You can find this derivation – as well as the objective function / gradient based derivation of other Jacobian based IK techniques – in this excellent slide deck by Stefan Schaal.
https://homes.cs.washington.edu/~todorov/courses/cseP590/06_JacobianMethods.pdf

Finally, we looked at the following recent paper, which presents a machine-learning view of inverse kinematics, with the user puppeteering a virtual human hand manipulating a virtual object in real-time.

Zhang, He, Yuting Ye, Takaaki Shiratori, and Taku Komura. "Manipnet: neural manipulation synthesis with a hand-object spatial representation." *ACM Transactions on Graphics (ToG)* 40, no. 4 (2021): 1-14. <https://github.com/cghezhang/ManipNet>
<https://www.youtube.com/watch?v=xvAq8ax5cuE>