POLITECHNIKA BIAŁOSTOCKA

WYDZIAŁ INFORMATYKI

PRACA DYPLOMOWA INŻYNIERSKA

TEMAT: SKELETAL ANIMATION USING INVERSE KINEMATICS IN THE UNITY ENGINE

WYKONAWCA: ŁUKASZ BIAŁCZAK

.....

podpis

PROMOTOR: DR INŻ. ADAM BOROWICZ

BIAŁYSTOK 2022 r.

Contents

1. Introduction

1.1 Motivation

1.2 Problem Formulation

In standard skeletal animation the skeleton is represented by a tree-like structure of transforms. Animation sequences are usually performed by updating the position and rotation attributes of these transforms starting from the root and propagating to the leaves. When applying inverse kinematics to skeletal animation, as the name suggests, the transforms are updated starting from a leaf and then back up the chain up to a selected node. This allows for a procedural approach to creating animation sequences which better reflect a realistic interaction between an animated object and its surroundings without the need to manually bake the sequence. Interactions such as a character pressing a sequence of buttons or pulling a lever are very well suited for the application of inverse kinematics. Adjusting a characters limbs to uneven terrain is another popular use for the technique. However, finding the proper parameter values for the skeletal transforms is not always a trivial task and may require advanced optimization methods. The purpose of this dissertation is to acquire a more in-depth understanding of the basic algorithms used in inverse kinematics, as well as discovering the built-in functionalities that the Unity engine offers which are geared towards such implementations.

2. Related Work

2.1 Overview

2.2 Use Cases

2.3 IK Algorithms

2.4 Advantages and Disadvantages

3. Inverse Kinematics in the Unity Engine

3.1 FABRIK implementation

3.2 Spider Movement

3.2.1 Project Setup

3.2.2 Scripts

3.3 Human Animation Sequence

3.3.1 Project Setup

3.3.2 Scripts

4. Experiments

5. Conclusion

Bibliography

[1] Jasvir Nagra, Clark D. Thomborson, and Christian S. Collberg. A functional taxonomy for software watermarking. In *ACSC*, pages 177–186, 2002.

[2] ISO/IEC-9126, International Standard ISO/IEC. In *Information technology: Software product evaluation: Quality characteristics and guidelines for their use*. International Standards Organisation, 1991.

[3] http://www.tex.ac.uk/cgi-bin/texfaq2html?label=multirow.

[4] http://www.texample.net/tikz/examples/computer-science-mindmap/.

[5] http://www.ctan.org/.

[6] H. Partl i inni T. Oetiker. Nie za krótkie wprowadzenie do systemu LaTeX.

[7] Wojciech Myszka. W³¹czanie grafik do tekstów w LaTeX.

[8] R. Kostecki. W miarê krótki i praktyczny kurs LaTeX w π^e minut.

[9] Forum gust. http://www.gust.org.pl/.

[10] Wykresy - TikZ & PGF Manual for Version 2.00.