KAIST

CS 380

Introduction to Computer Graphics

LAB (10)

2015.05.13

VISUAL COMPUTING Lab

Overview

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- Key Frame Animation (Part 2)
  - Refer to assignment 5 (code, pdf)

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Interpolation

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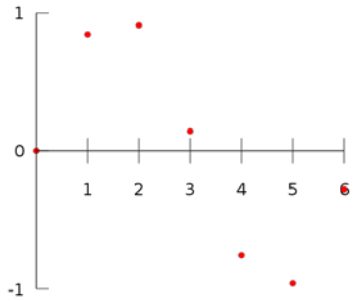
- From discrete data to continuous data



How to infer the value at x = 2.5, x = 4.2?

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Linear Interpolation

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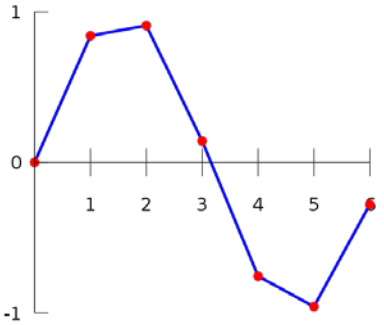
- Implemented in assignment 5



$$y = y_a + (y_b - y_a)\frac{x - x_a}{x_b - x_a}$$

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Polynomial interpolation

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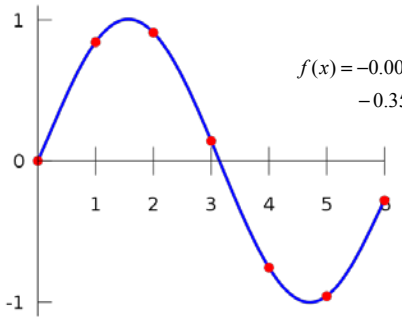
- Using higher degree polynomial



$$f(x) = -0.0001521x^6 - 0.003130x^5 + 0.07321x^4 - 0.3577x^3 + 0.2255x^2 + 0.9038x$$

5

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Spline interpolation

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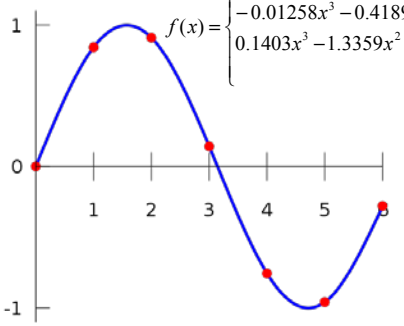
- Using low degree (= 3) polynomial for each interval

$$f(x) = \begin{cases} -0.1522x^3 + 0.9937x, & if\ x \in [0,1] \\ -0.01258x^3 - 0.4189x^2 + 1.4126x - 0.1396, & if\ x \in [1,2] \\ 0.1403x^3 - 1.3359x^2 + 3.2467x - 1.3623, & if\ x \in [2,3] \\ \cdots & \end{cases}$$



6

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Bezier cubic function

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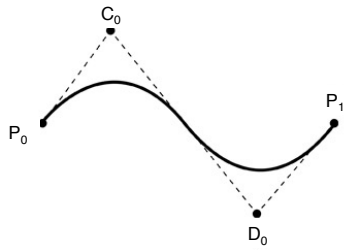
- Use four control values



$$c(t) = P_0(1-t)^3 + 3C_0\,t(1-t)^2 + 3D_0\,t^2(1-t) + P_1 t^3, \quad t \in [0,1]$$

7

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Catmull-Rom splines

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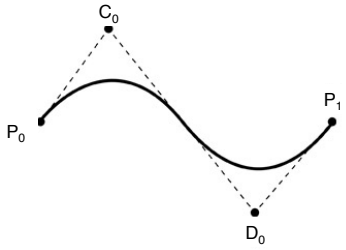
- Select the two middle control values using neighbor information



$$C_i = \frac{1}{6}(P_{i+1} - P_{i-1}) + P_i$$

$$D_i = \frac{-1}{6}(P_{i+2} - P_i) + P_{i+1}$$

8

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Task

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- Smooth interpolation using Catmull-Rom rule
  - Creating the key-frames = 1 to N
  - Interpolated key-frames = 2 to N-1 (first and last frame will be only used for selecting the control values)
- Cvec3 spline for translation
- Quat spline for rotation

9

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Results

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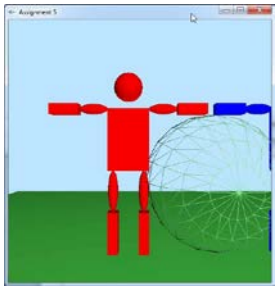
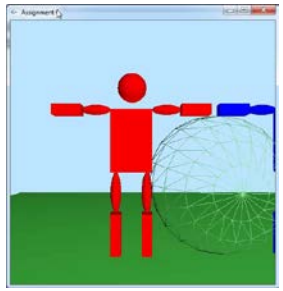
Linear interpolation



Catmull-Rom interpolation



10

VISUAL COMPUTING Lab