Lab 5: Cubic Splines

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Overview

Programming Exercise 5.1

Cubic Splines

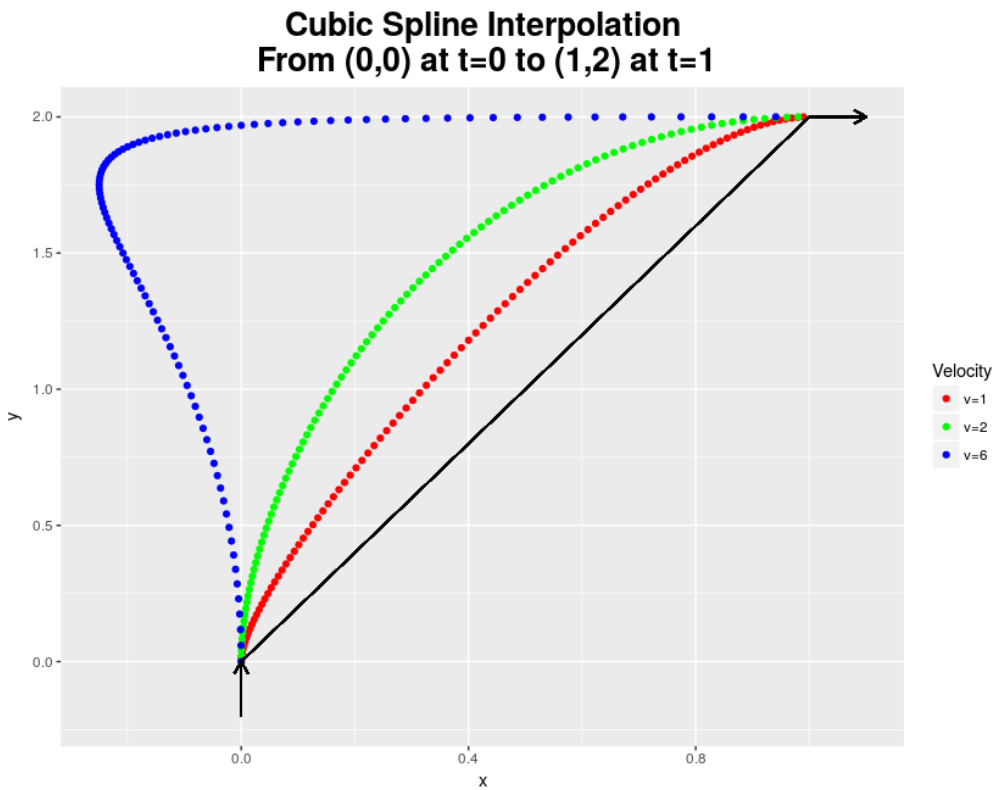
- Interpolate between two poitns
- Path goes through the two points
  - In contrast to Parabolic blends
- Each point can be specified with a velocity and/or time
- Cubic splines interpolate postions, velocities and accelerations to satisfy constraints
- Position, velocity and acceleration are contiuous

Cubic Splines

- Implement this function and test it on a 2D path

$$
\begin{aligned}
C(t, t_s, t_f, P_s, P_f, V_s, V_f) &= [-2(P_f - P_s) + (t_f - t_s)(V_s + V_f)] \left[\frac{t - t_s}{t_f - t_s}\right]^3 \\
&+ [3(P_f - P_s) - (t_f - t_s)(2V_s + V_f)] \left[\frac{t - t_s}{t_f - t_s}\right]^2 \\
&+ V_s(t - t_s) + P_s \qquad (5.22)
\end{aligned}
$$

Programming Exercise 5.1



- Arrows show the direction of velocities at the start and end points
- Linear interpolation shown as reference (black line)
- Velocities:
  - Red - $(0, 1) \rightarrow (1, 0)$
  - Green - $(0, 2) \rightarrow (2, 0)$
  - Blue - $(0, 6) \rightarrow (6, 0)$