

- Arc-length Reparameterization
  - Adaptive Gaussian Quadrature for estimating arc length
  - Mapping from frame number to arc length to parameter value (i.e. computing  $u(s(f))$ ).
- Interpolation
  - Interpolation vs. Approximation
  - Continuity
  - Global vs. Local Control
  - Hermite, Catmull-Rom, and B-splines
- Representing and Interpolating Orientations
  - Rotation Matrices
  - Fixed Angle
  - Euler Angle
  - Axis and Angle
  - Quaternion
  - Slerp
  - Qlerp
- Ease-in/Ease-out
  - Monotonic curves don't go backwards in time
  - Continuity ensure there is not a jump
  - Sine interpolation
  - Using sinusoidal pieces for acceleration and deceleration
  - Cubic polynomial
  - Parabolic (constant acceleration)
- Paths
  - Frenet Frame
  - Camera path following (center of interest)
  - Smoothing paths
- Kinematic Chains and Inverse Kinematics
  - Kinematic hierarchies
  - Reduced Coordinates

- Forward kinematics (descending the hierarchy)
- Inverse kinematics
- Jacobian (what it is, how entries are computed)
- Pseudo-inverse, Jacobian transpose (gradient descent)
- Cyclic coordinate descent
- Adding secondary constraints in the null-space of the Jacobian
- Motion Capture
  - The motion capture process
  - Camera calibration
  - Actor calibration
  - T-pose, motorcycle pose, range of motion
  - Capturing 3D positions
  - Computing trajectories
  - Skeleton template
  - Skeleton Fitting
  - Editing motion capture data: Warping, retargeting, graphs
- Simulation and Optimization
  - Lagrangian mechanics
  - Featherstone dynamics
  - Control systems
  - Finite state machines
  - Control laws and goal joint angles
  - Proportional derivative controller
  - Constrained optimization
  - Energy functions (e.g. minimize joint torques)
  - The importance of contact