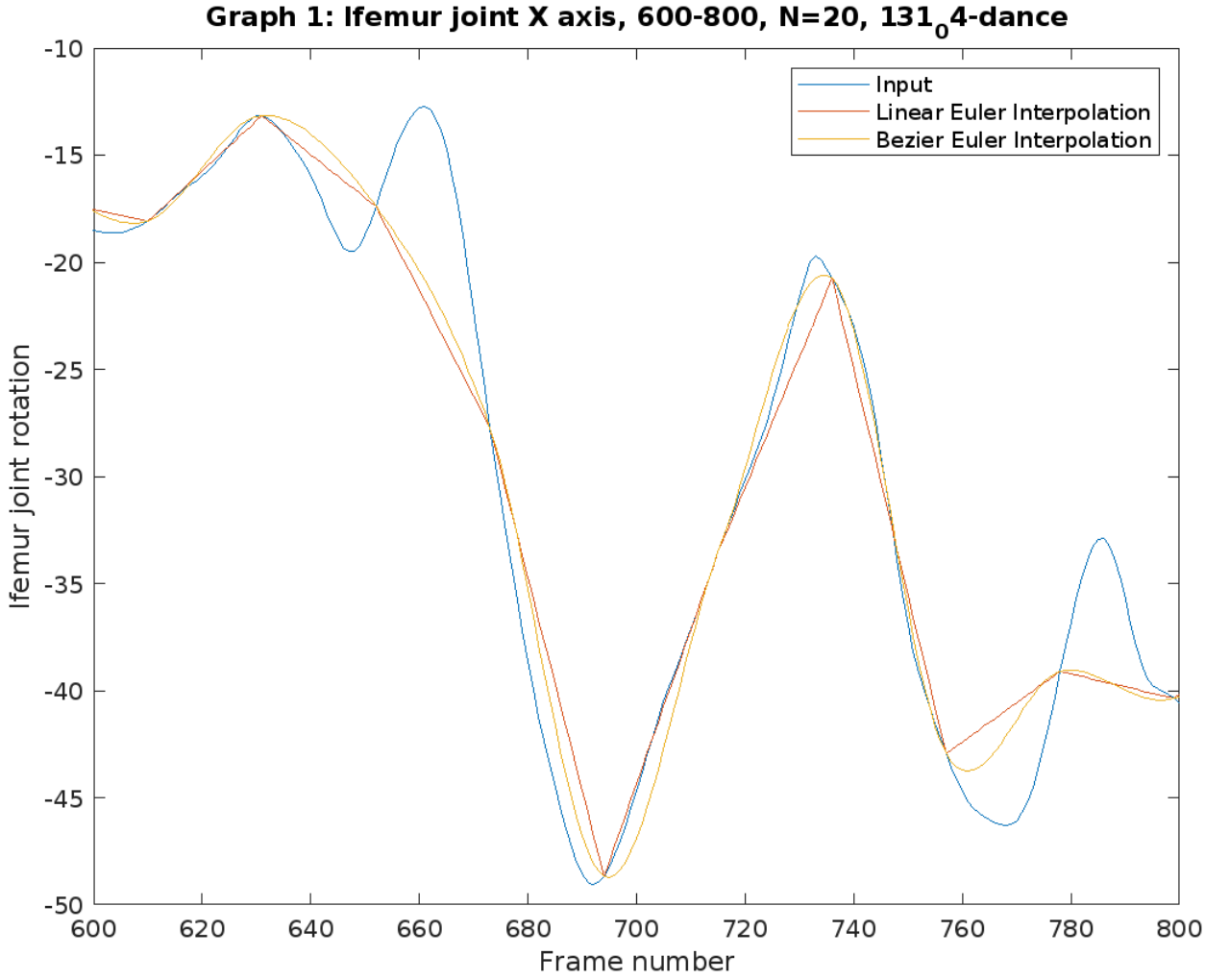
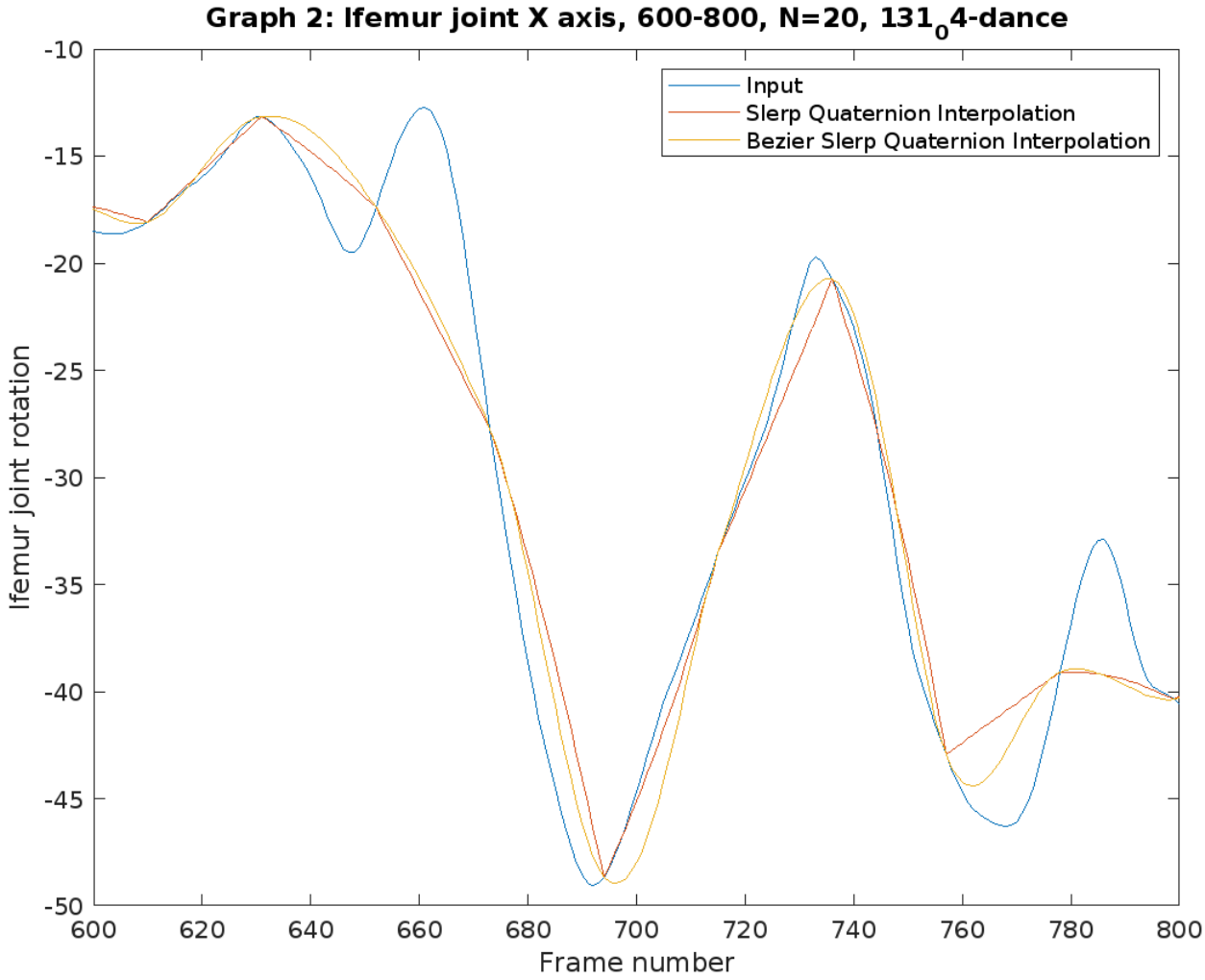
Joint Interpolation Analysis

Graph 1: Linear Euler vs Bezier Euler



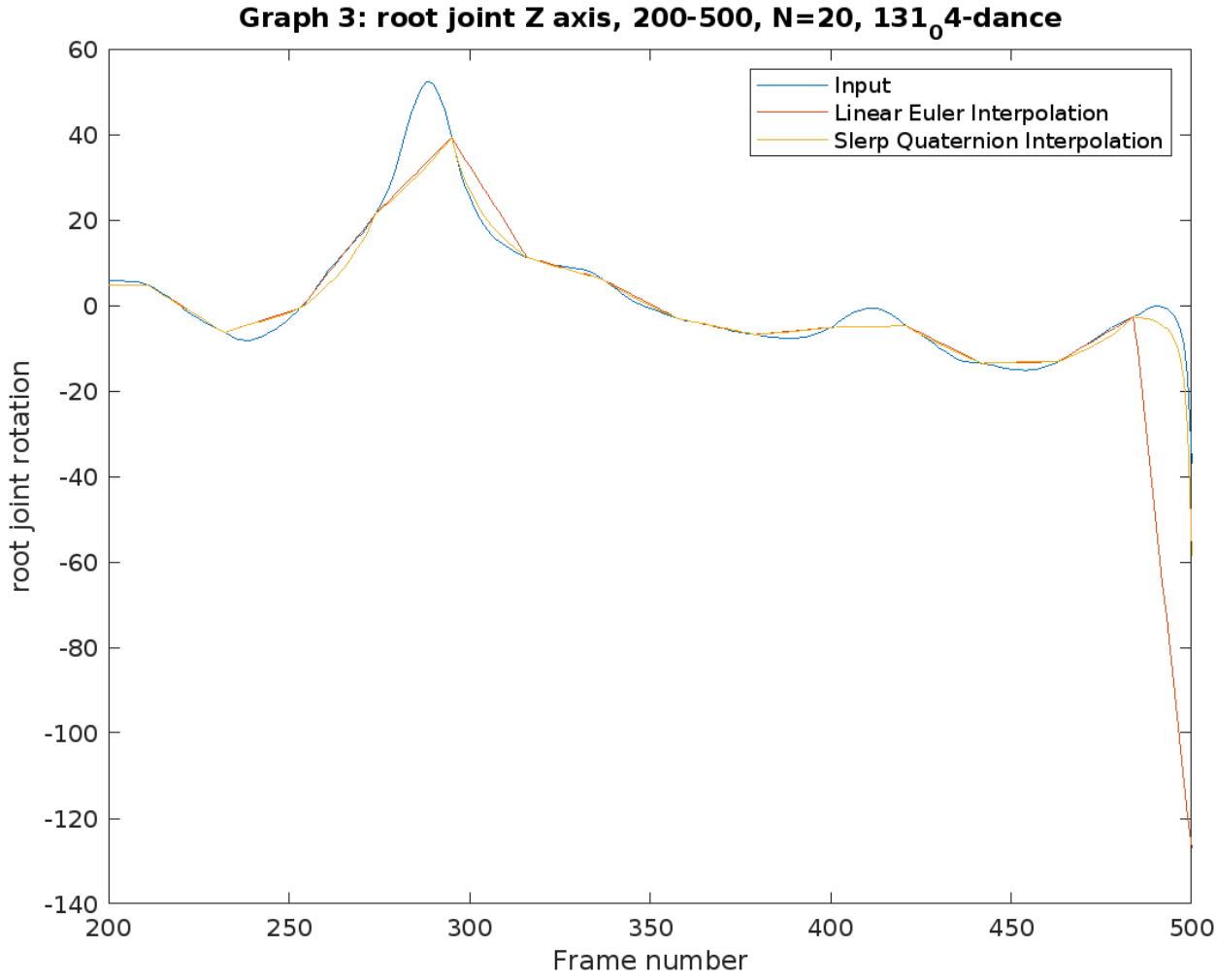
Bezier Euler interpolation is smoother, whereas linear Euler interpolation shows sudden spikes in certain frames (especially around frames 720 - 740). Very rigid and sharp spikey segments can be seen around frames 640-660, frames 720-740, and frames 760-780. Because the number of skipped frames is set to be N = 20, there are certain nuances that both methods, understandably, miss out on the nuances in the original motion file (around frames 660 - 680 and 780 - 800).

Graph 2: Slerp Quaternion vs Bezier Slerp Quaternion



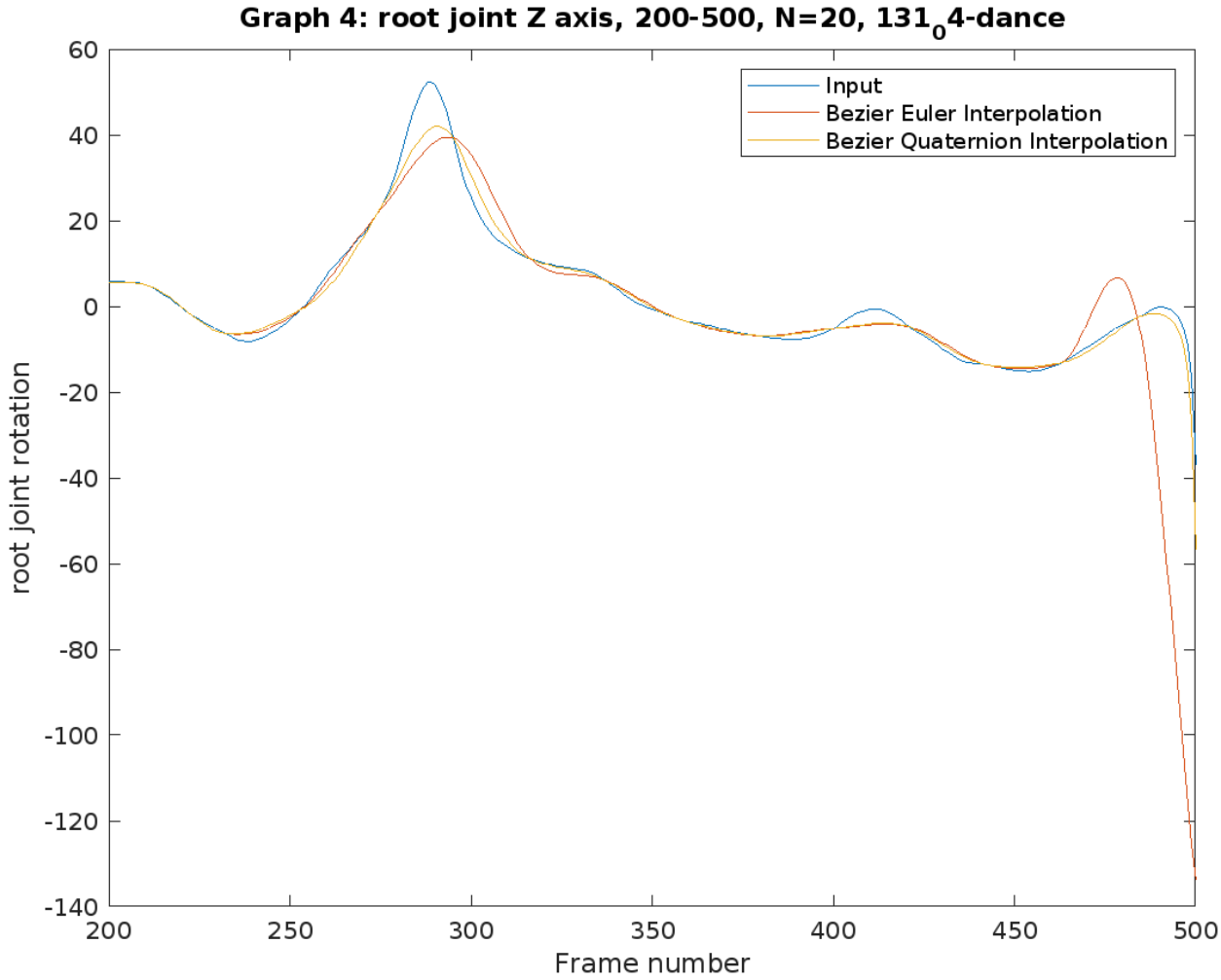
Bezier Slerp Quaternion interpolation produces a smoother result (as seen in the smoother slope) than simple linear Slerp Quaternion interpolation. For example, during the change of rotation between frame 640 and 660, Slerp Quaternion's slope looks like a straight line whereas Bezier Slerp is more like a smooth slope going down gradually (thus more stable). The same behavior happens again in the spike during frames 720 and 740: Slerp Quaternion is a sharp spike compared to Bezier Slerp's more stable rotation change. Because the number of skipped frames is set to be N = 20, there are certain nuances that both methods, understandably, miss out on in the original motion file (around frames 660 - 680 and 780 - 800).

Graph 3: Linear Euler vs Slerp Quaternion



Though both methods produce somewhat similar results, and both show sharp slopes (less smooth than their Bezier counterparts), Slerp Quaternion is smoother than Linear Euler. We can see the biggest difference around frame 300 and between frames 450-500 where Linear Euler looks like a triangle compared to Slerp Quaternion. Linear Euler just plummets towards the end of frame 500, but Slerp Quaternion remains to be closer to the input.

Graph 4: Bezier Euler vs Bezier Slerp Quaternion



Both results are smooth and mostly follow the input motion as much as possible. Bezier Euler is not as stable as Bezier Quaternion, notably between frames 470-500 where Bezier Euler has a sudden upturn that's uncharacteristic of the original input, but Bezier Quaternion continues to closely follow the input.

Conclusion: Euler interpolations are generally less stable compared to Quaternion interpolations, and Linear interpolations also give less ideal results compared to Bezier interpolations.

Extra Credit: Runtime Analysis

Input: for **N=20**, for **131_04-dance.amc** input file.

- Method 1: Linear Euler takes 61ms = 0.061s.
- Method 2: Bezier Lerp Euler takes 521ms = 0.5s.
- Method 3: Slerp Quaternion takes 1715ms = 1.7s.

- Method 4: Bezier Slerp Quaternion takes 3627ms = 3.6s.