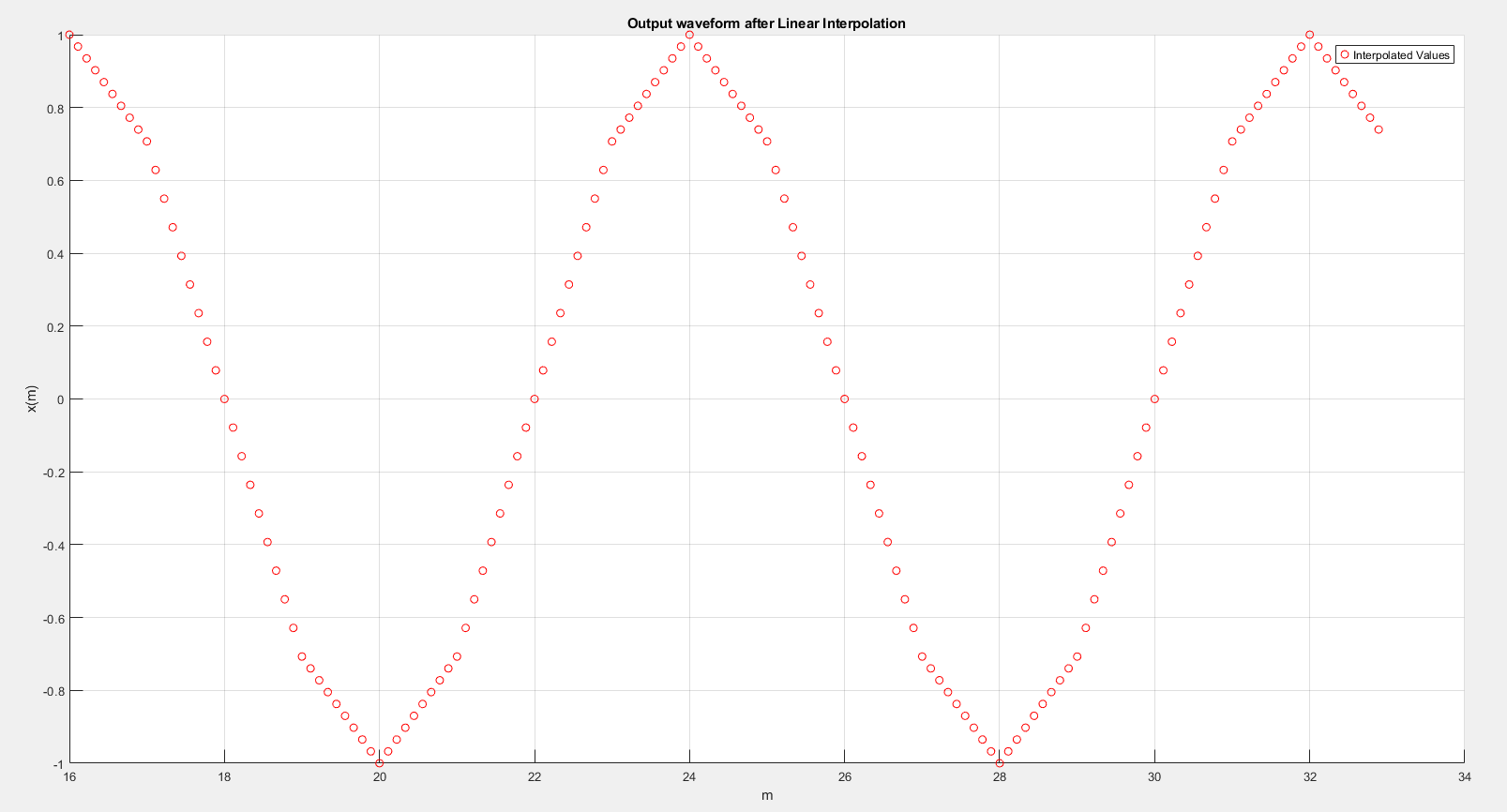
DSP in VLSI

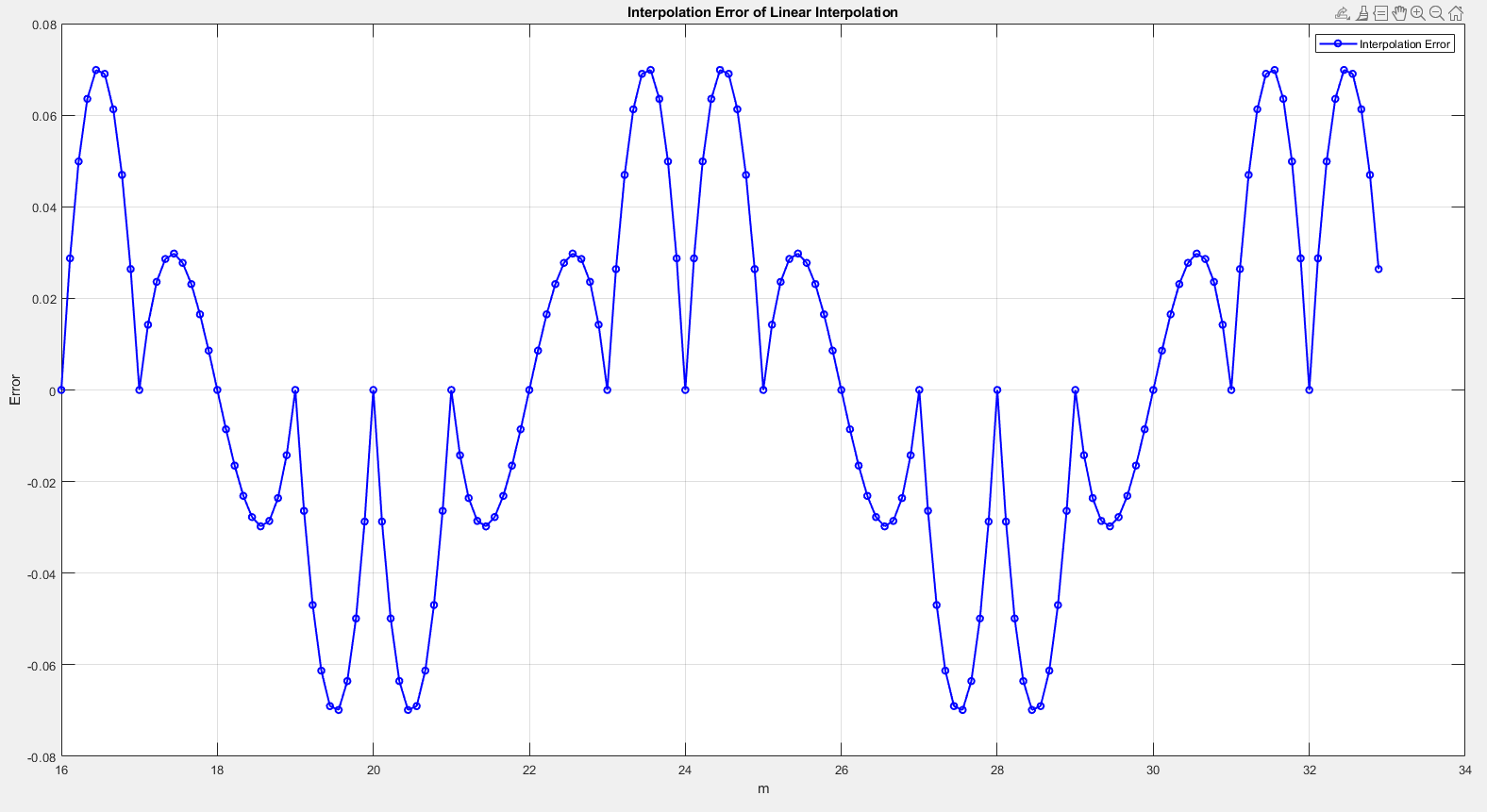
HW3

電子所ICS組, R13943015, 張根齊

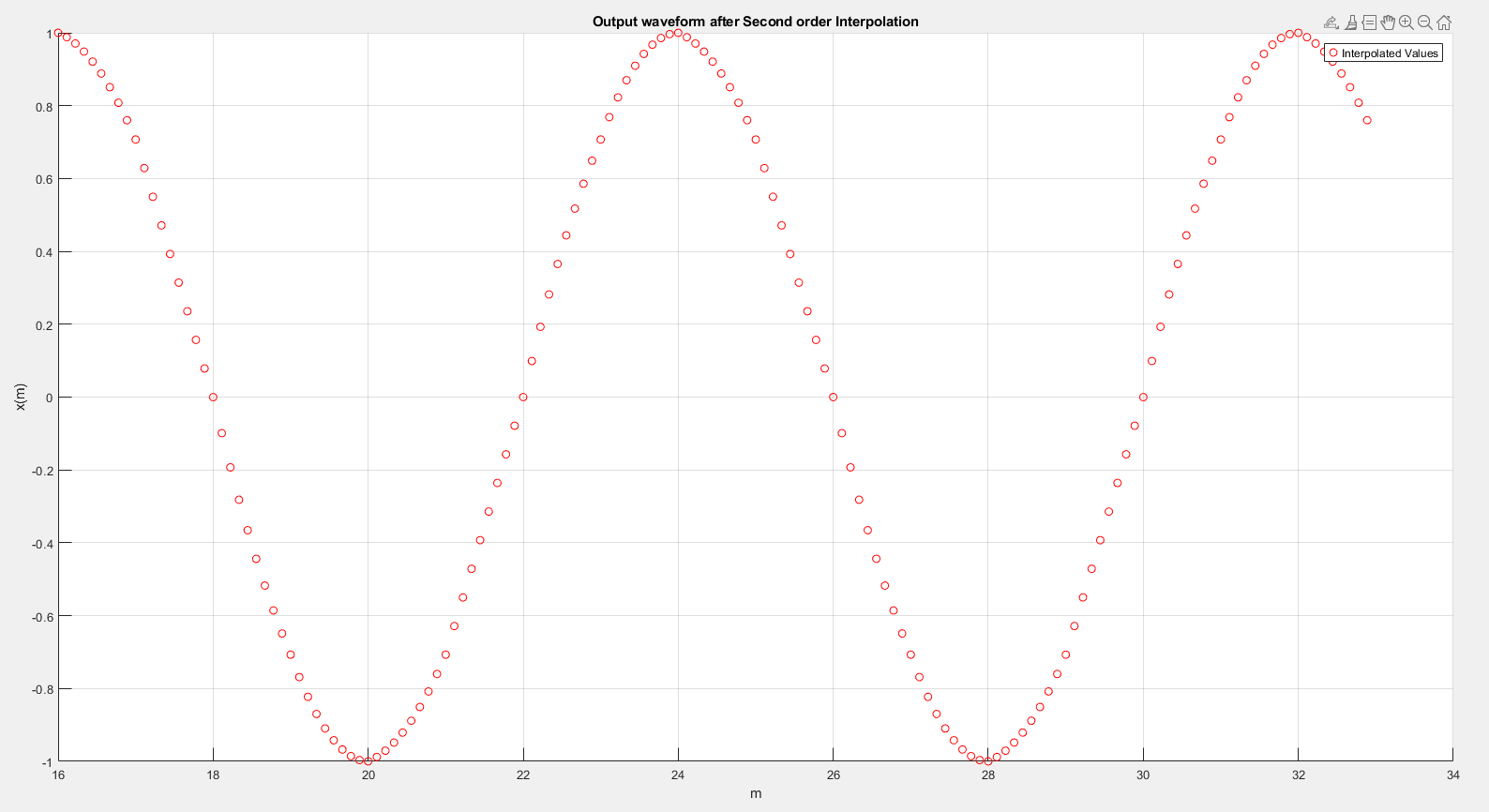
1. (Step 1) Show the output waveform after interpolation using linear interpolator, second-order polynomial interpolator, and piecewise parabolic interpolator to interpolate the sampled waveform in the region of 16 ≤ 𝑚 ≤ 32 with 𝜇 = 0, 1/9 , 2/9 , … 8/9 . In addition, draw the error in the region of 16 ≤ 𝑚 ≤ 32 with 𝜇 = 0, 1/9 , 2/9 , … 8/9 . (30%)

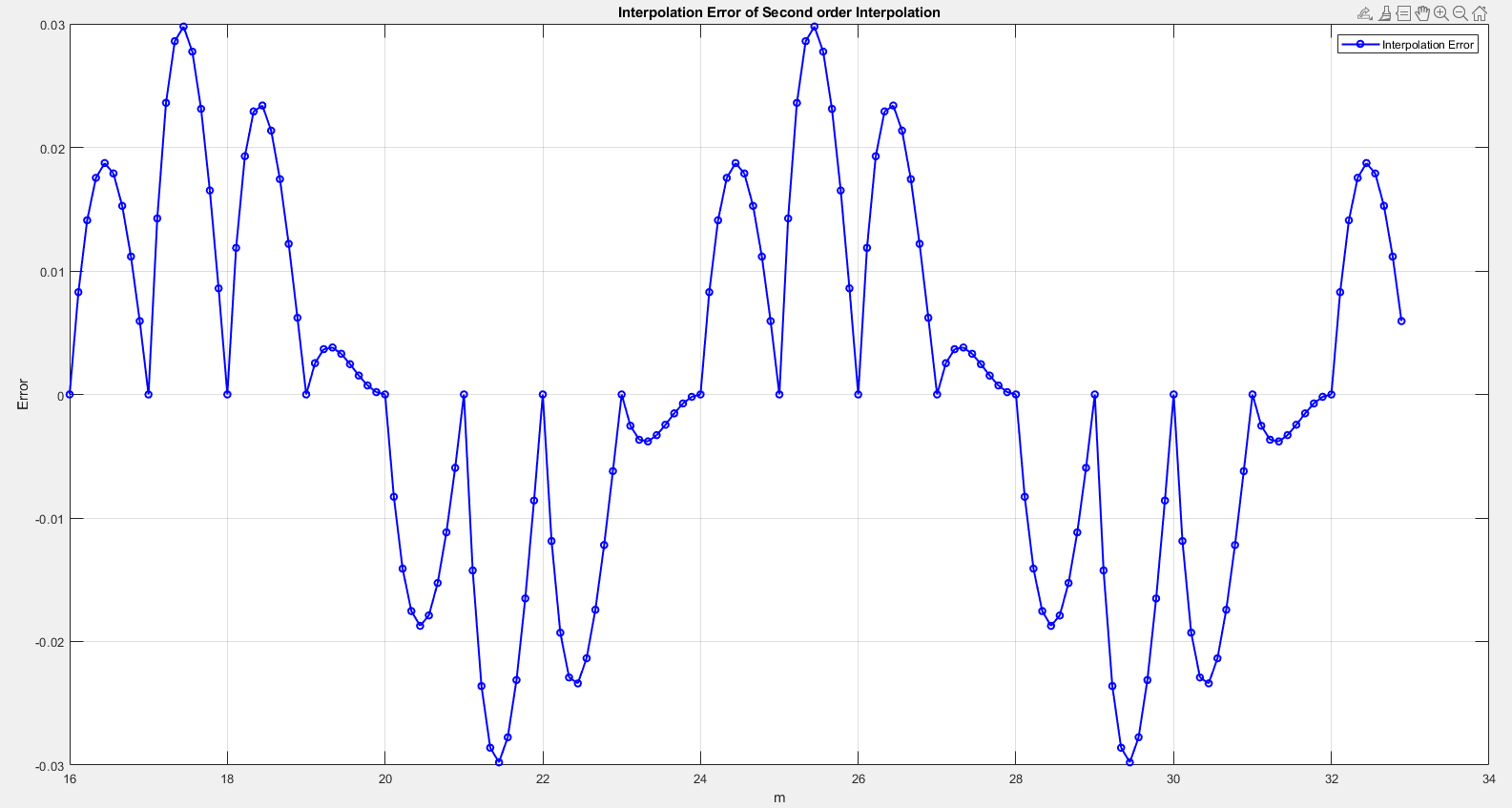
1-1. Linear interpolator output waveform and error



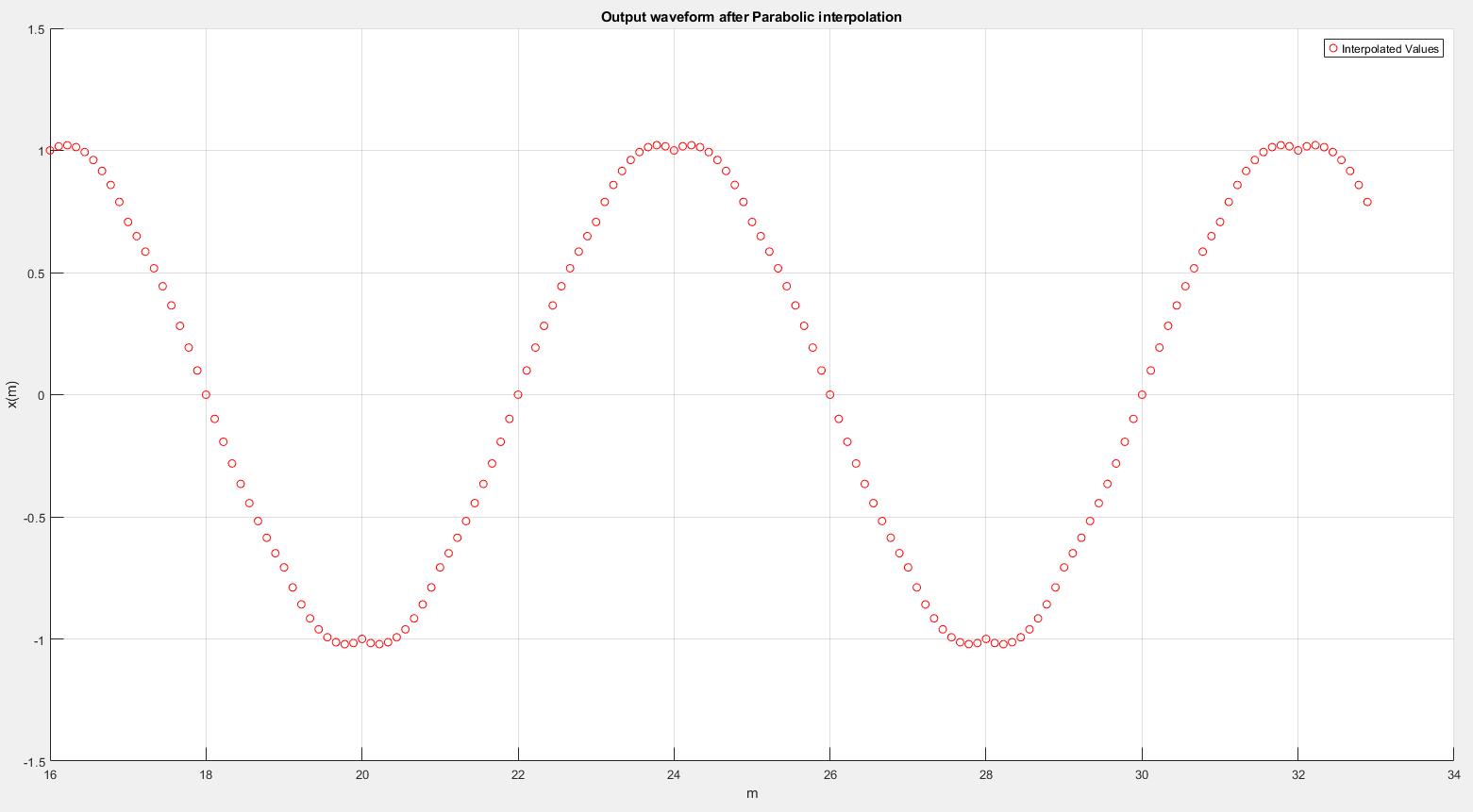


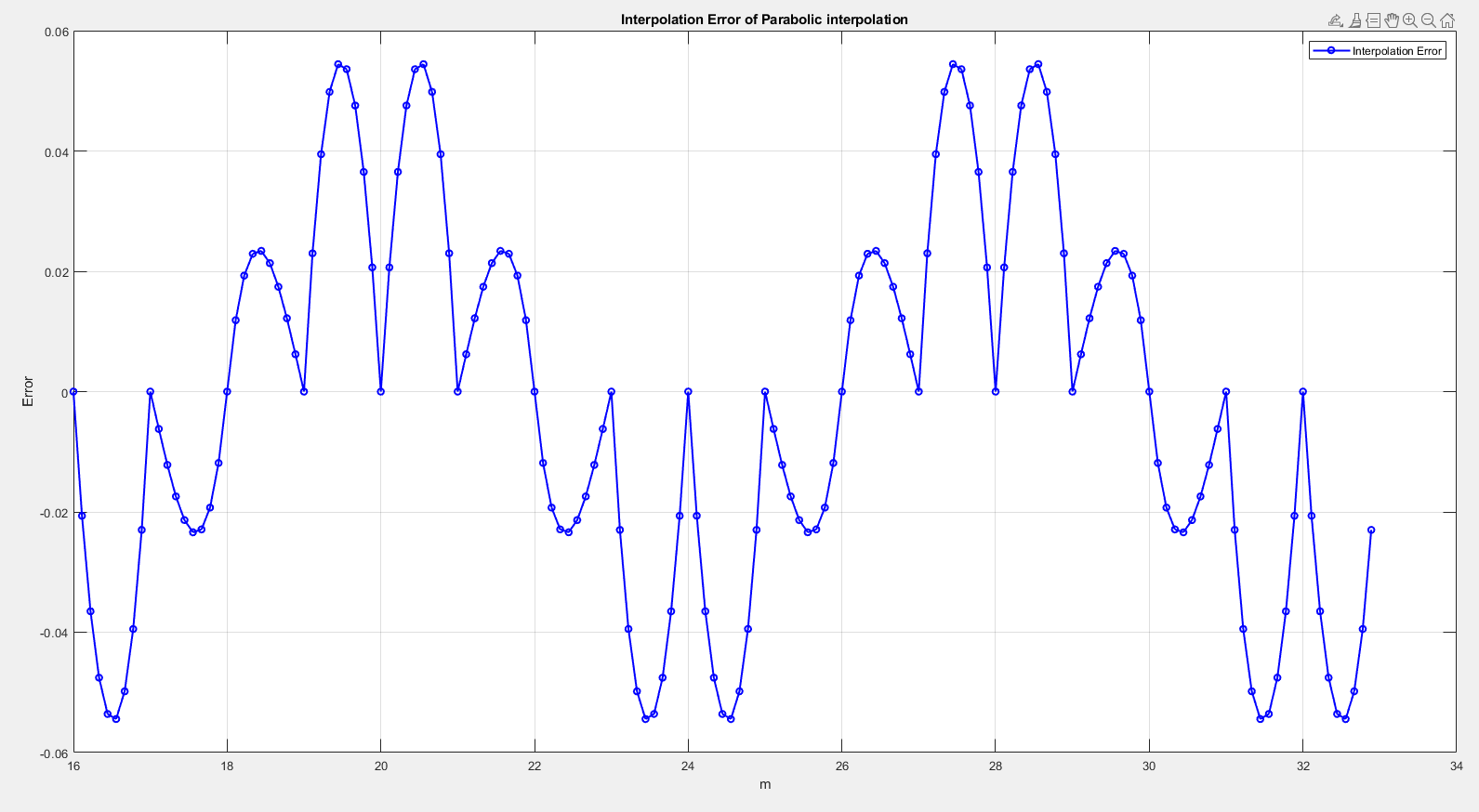
1-2. Second-order polynomial interpolator output waveform and error





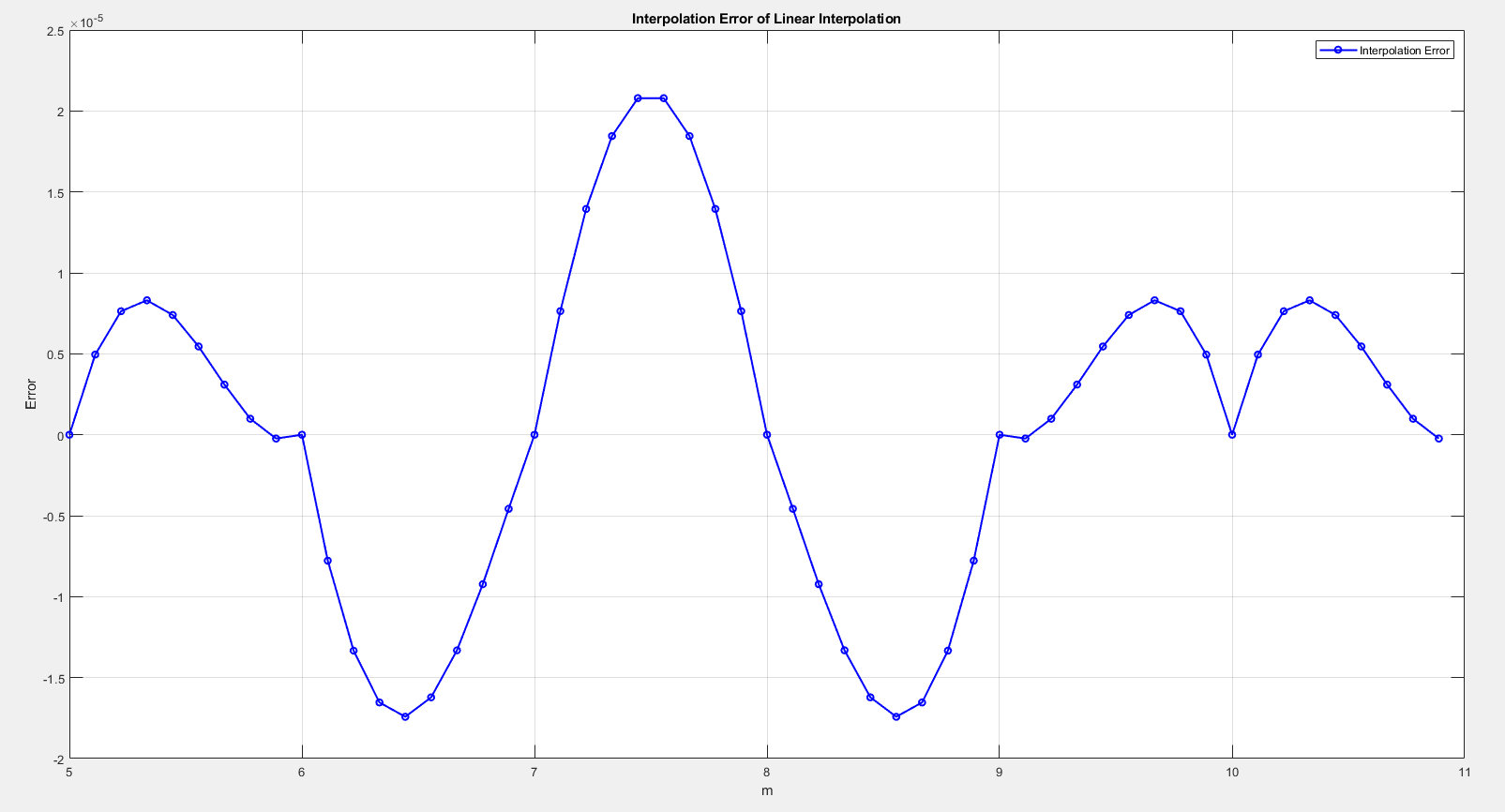
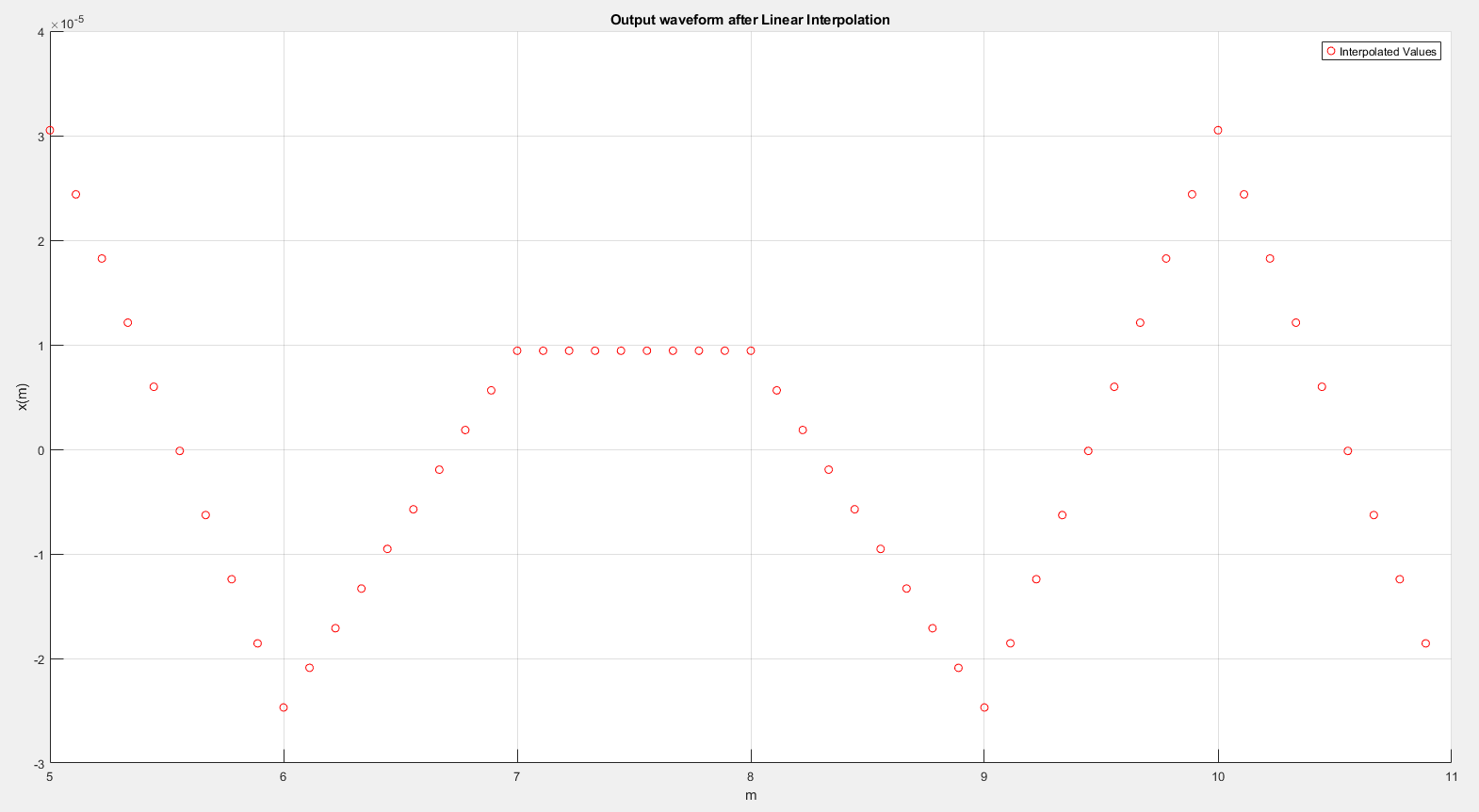
1-3. piecewise parabolic interpolator output waveform and error



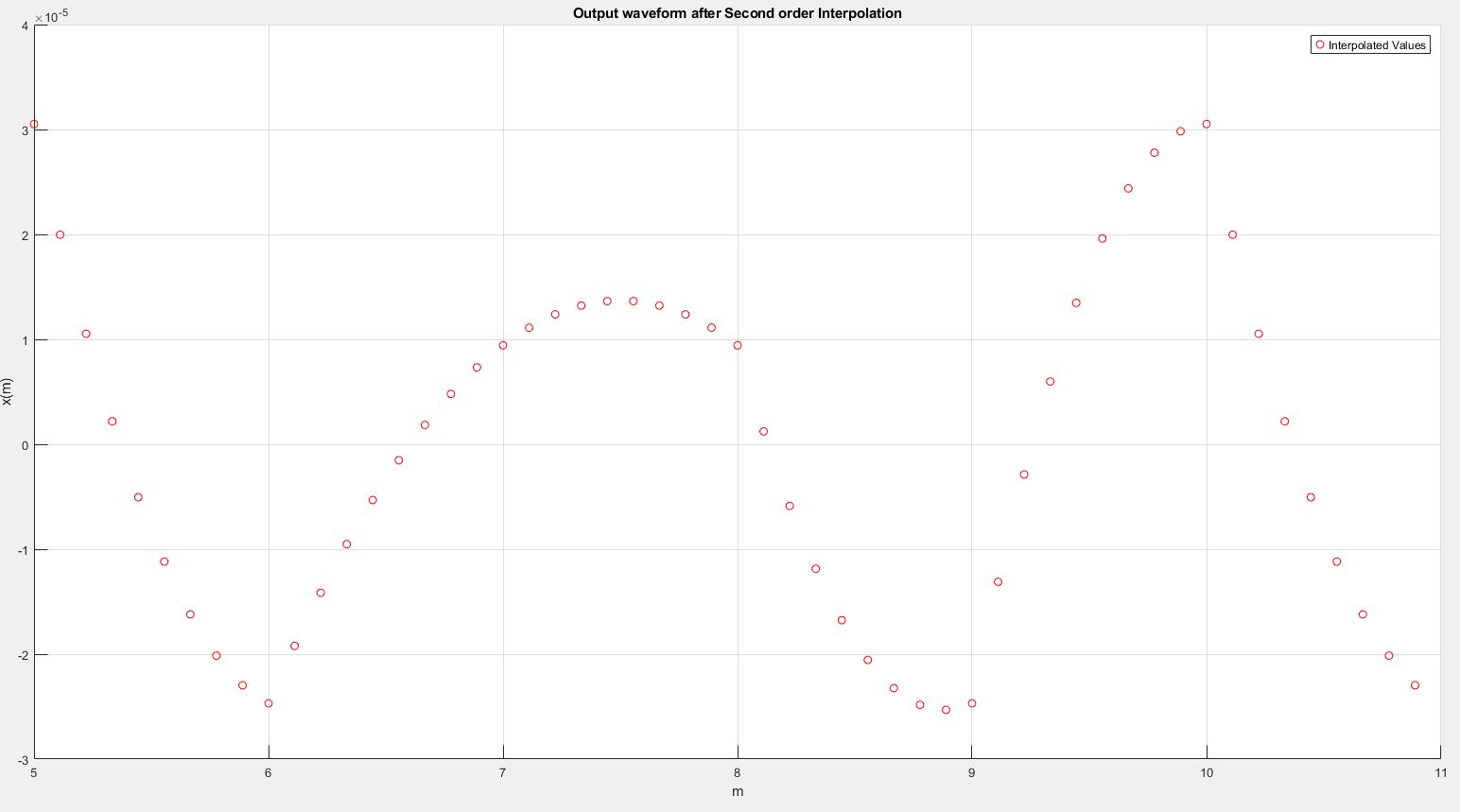


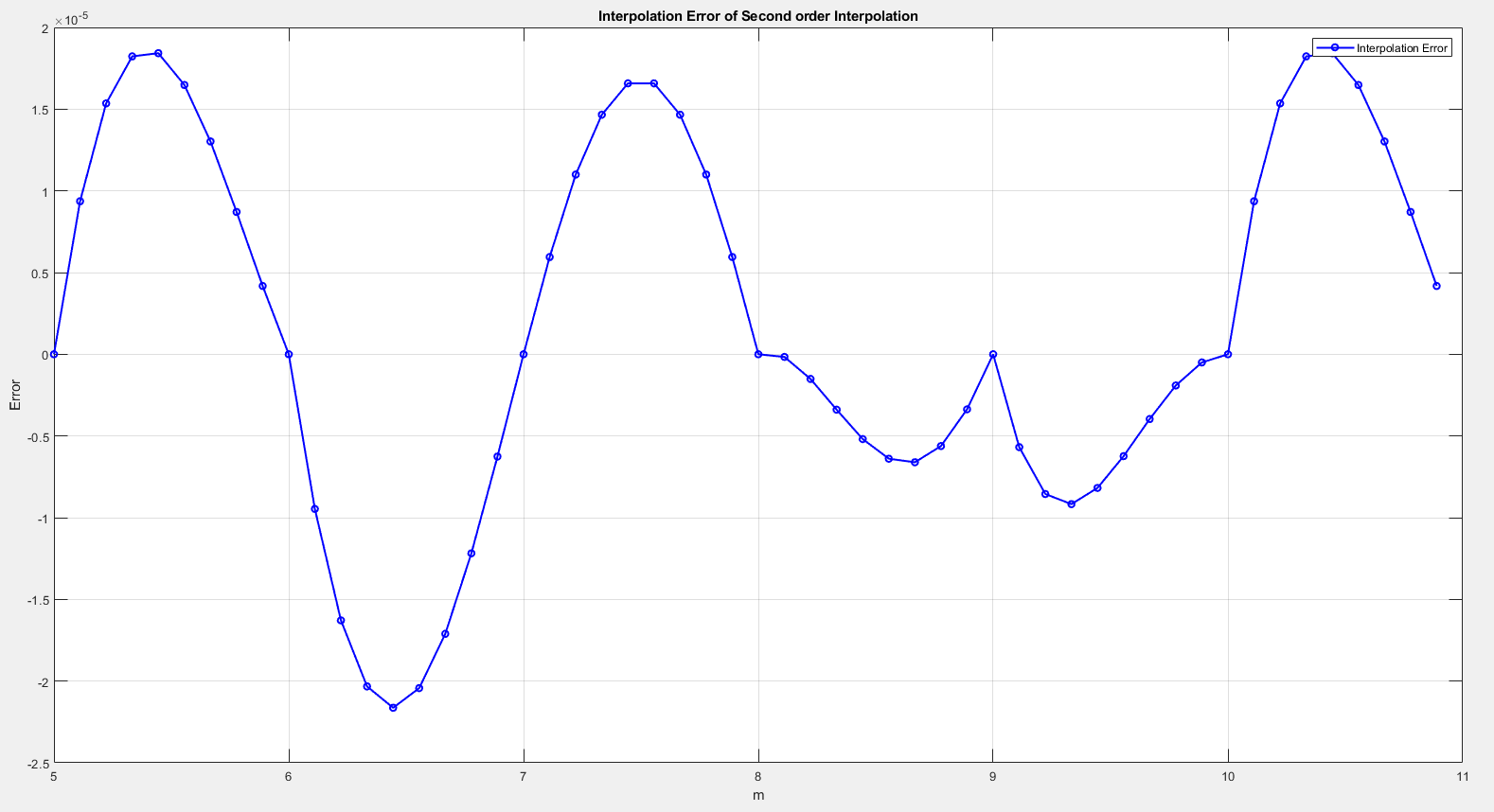
2. (Step 2) Show the output waveform after interpolation using linear interpolator, second-order polynomial interpolator, and piecewise parabolic interpolator to interpolate the sampled waveform in the region of 5 ≤ 𝑚 ≤ 10 with 𝜇 =0, 1/9, 2/9, …8/9. In addition, draw the error in the region of 5 ≤ 𝑚 ≤ 10 with 𝜇 =0, 1/9, 2/9, …8/9.

2-1. Linear interpolator output waveform and error

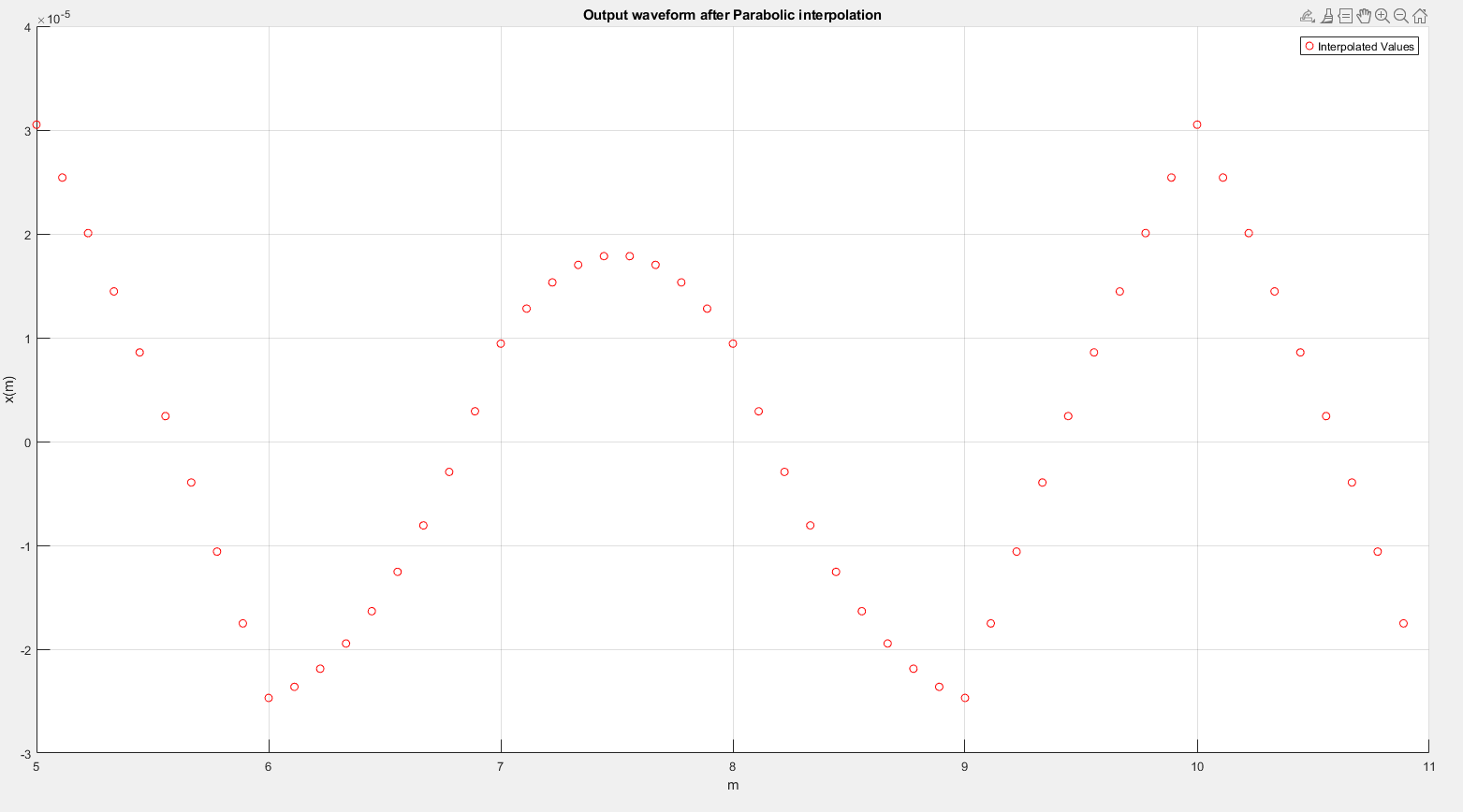


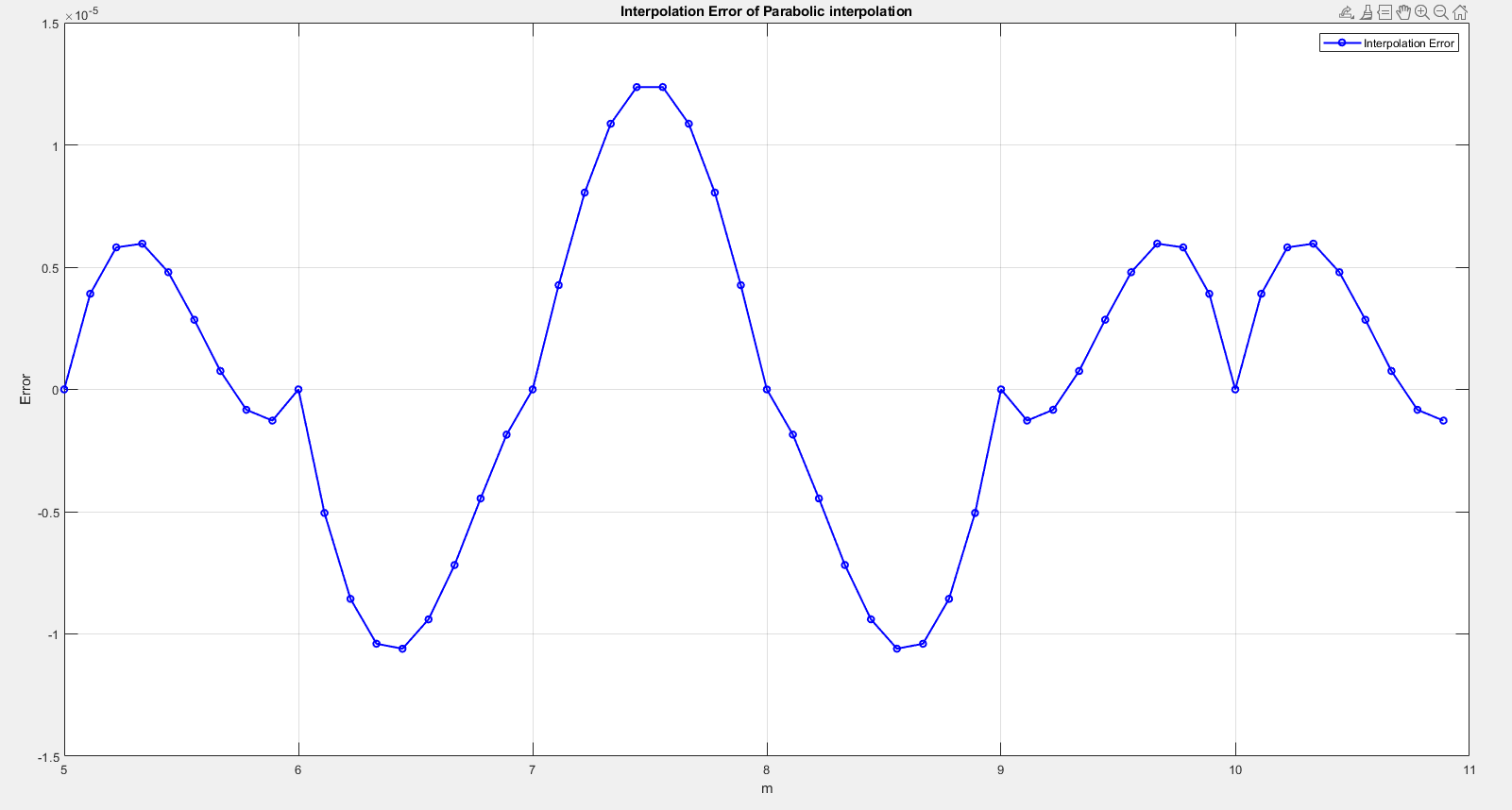
2-2. Second-order polynomial interpolator output waveform and error





2-3. piecewise parabolic interpolator output waveform and error





3. (Step 3) Please show the results that are calculated by your bit-true model for the following operands and operators. Express results both in decimal and binary representation. (S, E, F mean the sign bit, exponent field, and fraction field. All are given in binary.)

|  |  |  |  |
| --- | --- | --- | --- |
| Operation | Operand 1 | Operand 2 | Result |
| Addition | S: 1  E: 10000011  F: 0000000111  Decimal: - 16.109375 | S: 0  E: 10000011  F:0000000101  Decimal: 16.078125 | S: 0  E: 01111010  F:0000000000  Decimal: -0.03125 |
| Addition | S: 1  E: 10000011  F: 0000000111  Decimal: -16.109375 | S: 1  E: 10010011  F: 0000000101  Decimal: -1053696.0 | S: 1  E: 10010011  F: 0000000101  Decimal: -1053696.0 |
| Multiplication | S: 1  E: 00100011  F: 1100000111  Decimal: -3.547902E-28 | S: 0  E: 10000011  F: 1111000101  Decimal: 31.078125 | S: 1  E: 00101000  F: 1011010011  Decimal: -1.102512E-26 |
| Multiplication | S: 0  E: 01100011  F: 0011110111  Decimal: 4.623871E-9 | S: 0  E: 10000011  F: 0011001111  Decimal: 19.234375 | S: 0  E: 01100111  F: 0111111000  Decimal: 8.8941306E-8 |

4. (Step 4) Show the interpolation differences of the piecewise parabolic interpolator using TF32 and double-precision (default precision of Matlab) arithmetic operations. Draw the figures indicating difference of interpolated results caused by data format for inputs 𝑥1[𝑚] in the region of 16 ≤ 𝑚 ≤ 32 with 𝜇 =0, 1/9, 2/9, … 8/9. and 𝑥2[𝑚] in the region of 5 ≤ 𝑚 ≤ 10 with 𝜇 = 0, 1/9, 2/9, … 8/9. (20%)