HW6

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Considerations

1. Simulation developed in MATLAB R2015b

2. Calling ICP code developed by Jakob Wilm & Hans Martin KjerAll, Copyright (c) 2012

3. First, the data from table1, Page 249 from "A method for Registration of 3-D Shapes" are simulated. It is considered 1, 6 and 10 iterations

4. Second, it is considered an array with the initial 200.000 data of the files "pointcloud1.fuse" and "pointcloud2.fuse" with 1, 6 and 10 iterations

5. Third, it is considered an array of all data of the files "pointcloud1.fuse" and "pointcloud2.fuse" with 1, 6 and 10 iterations
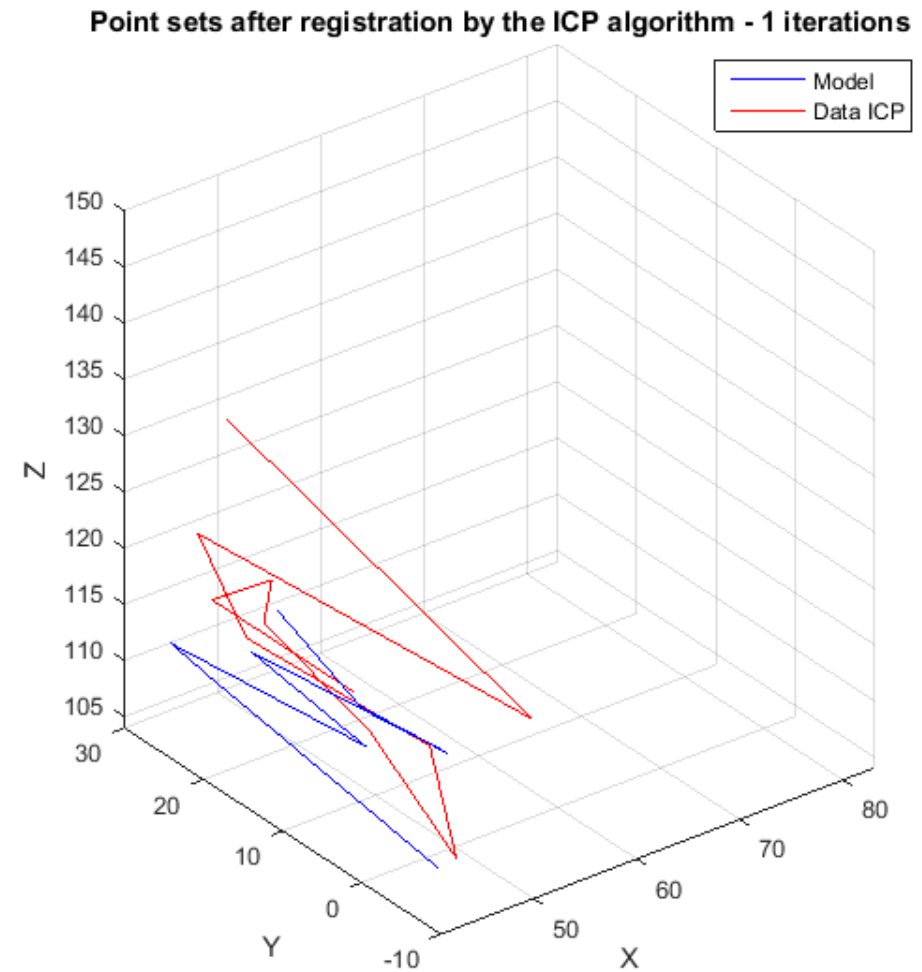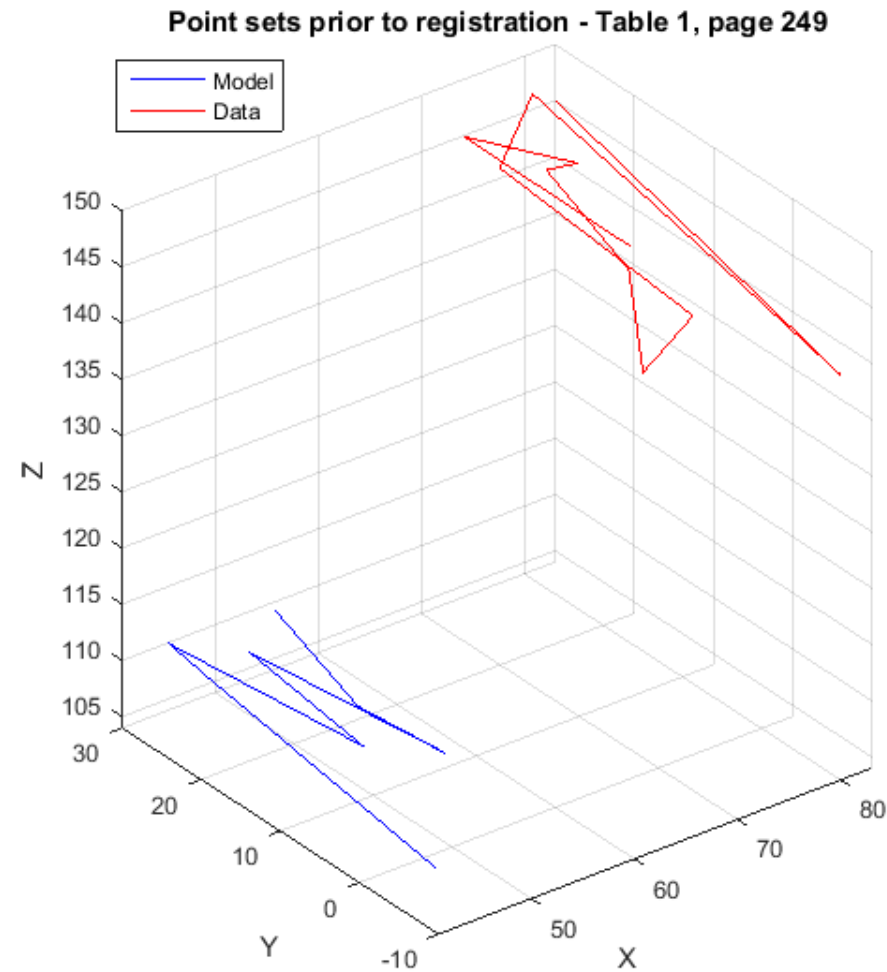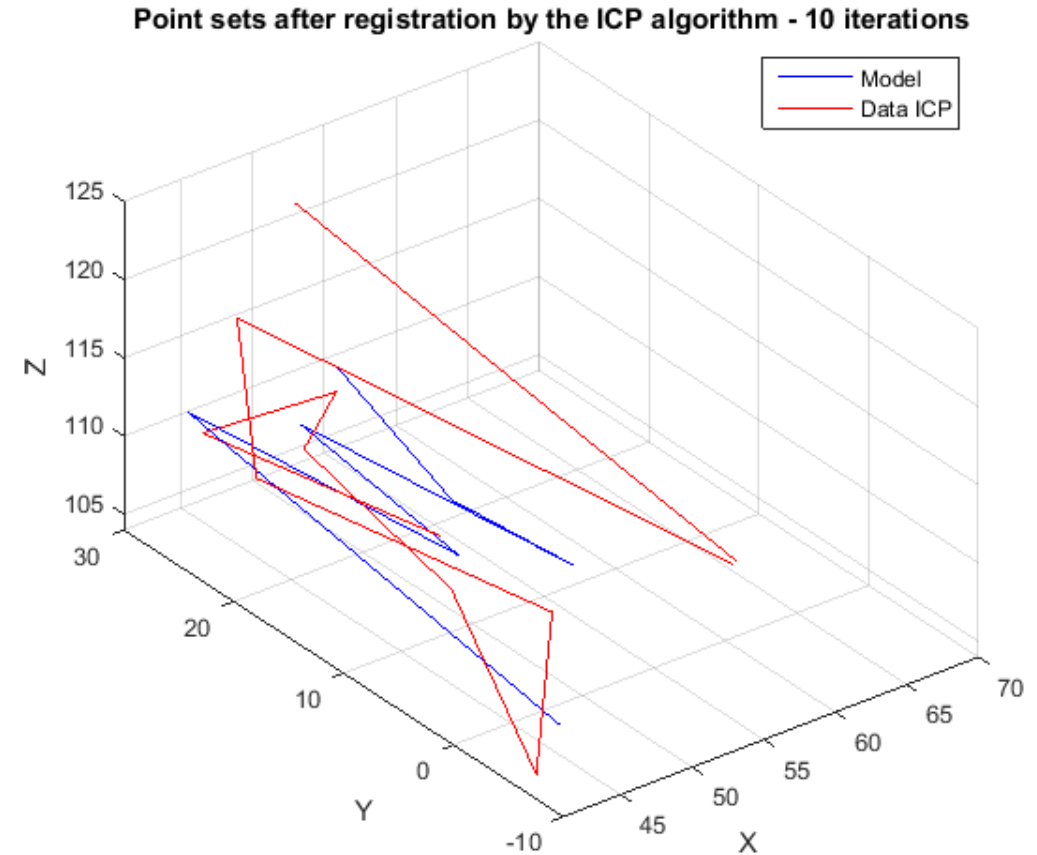
6. Attached the scripts used

call_ICP.txt   icp_routine.txt

Data Table 1, page 249

Point sets prior to registration - Table 1, page 249

Point sets after registration by the ICP algorithm - 1 iterations

Data Table 1, page 249

Point sets after registration by the ICP algorithm - 6 iterations

Point sets after registration by the ICP algorithm - 10 iterations
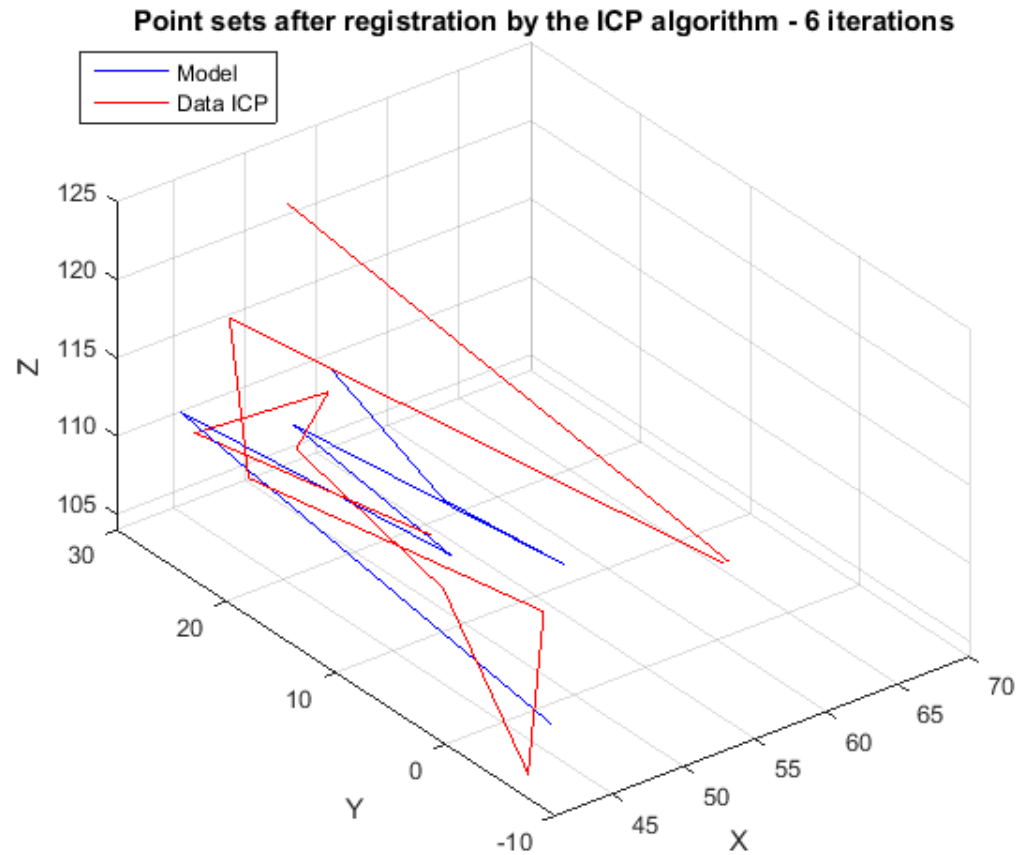
Preliminary

$$Data_{ICP} = Rotation \times Data^{T} + Translation$$

Data $_{ICP}$ = Data after registration by ICP algorithm

Rotation = Rotation Matrix

Data = Data 'pointcloud2.fuse'

Translation = Translation Matrix

Model= Data 'pointcloud1.fuse'

*T= transposed matrix

FORMAT DATA		
X	Y	Z
Intensity		
48,8588580000000 29	2,29952500000000	76,9953100000000
48,8588580000000 18	2,29952900000000	77,0080510000000
48,8588580000000 11	2,29953200000000	77,0017480000000
48,8588580000000 38	2,29953400000000	77,0020830000000
48,8588580000000 13	2,29953600000000	77,0057770000000
48,8588580000000 20	2,29953800000000	77,0790320000000
48,8588580000000 3	2,29954000000000	77,1124920000000

Partial data 200.000 points – Transformation Matrix (3x3)

$$\text{Rotation}_{(\text{iteration}=1)} = \begin{bmatrix} 0.998647819 & 0.051985904 & -2.87E-06 \\ -0.0519859 & 0.998647819 & -3.67E-07 \\ 2.85E-06 & 5.16E-07 & 1 \end{bmatrix}$$

$$\text{Translation}_{(\text{iteration}=1)} = \begin{bmatrix} -0.053225429 \\ 2.543121366 \\ 0.003359531 \end{bmatrix}$$

Runtime routine = 481.68 s

$$\text{Rotation}_{(\text{iteration}=6)} = \begin{bmatrix} 0.991058266 & 0.133429809 & -1.51E-06 \\ -0.13342981 & 0.991058266 & -3.99E-07 \\ 1.45E-06 & 5.97E-07 & 1 \end{bmatrix}$$

$$\text{Translation}_{(\text{iteration}=6)} = \begin{bmatrix} 0.130213226 \\ 6.539833942 \\ 0.015613276 \end{bmatrix}$$

Runtime routine = 10941.39 s

$$\text{Rotation}_{(\text{iteration}=10)} = \begin{bmatrix} 0.991715012 & 0.12845752 & -1.50E-06 \\ -0.12845752 & 0.991715012 & -2.88E-07 \\ 1.45E-06 & 4.79E-07 & 1 \end{bmatrix}$$

$$\text{Translation}_{(\text{iteration}=10)} = \begin{bmatrix} 0.109557569 \\ 6.295374314 \\ 0.021844462 \end{bmatrix}$$

Runtime routine = 29244.90 s

Partial data 200.000 points – Transformation Matrix (4x4)

$$\text{Rotation}_{(iteration=1)} = \begin{bmatrix} 0.998647819 & 0.051985904 & -2.87E-06 & 0 \\ -0.0519859 & 0.998647819 & -3.67E-07 & 0 \\ 2.85E-06 & 5.16E-07 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$\text{Translation}_{(iteration=1)} = \begin{bmatrix} -0.053225429 \\ 2.543121366 \\ 0.003359531 \\ 0 \end{bmatrix}$$

$$\text{Rotation}_{(iteration=6)} = \begin{bmatrix} 0.991058266 & 0.133429809 & -1.51E-06 & 0 \\ -0.13342981 & 0.991058266 & -3.99E-07 & 0 \\ 1.45E-06 & 5.97E-07 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$\text{Translation}_{(iteration=6)} = \begin{bmatrix} 0.130213226 \\ 6.539833942 \\ 0.015613276 \\ 0 \end{bmatrix}$$

$$\text{Rotation}_{(iteration=10)} = \begin{bmatrix} 0.991715012 & 0.12845752 & -1.50E-06 & 0 \\ -0.12845752 & 0.991715012 & -2.88E-07 & 0 \\ 1.45E-06 & 4.79E-07 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$\text{Translation}_{(iteration=10)} = \begin{bmatrix} 0.109557569 \\ 6.295374314 \\ 0.021844462 \\ 0 \end{bmatrix}$$

Total data– Transformation Matrix (3x3)

$$\text{Rotation}_{(\text{iteration}=1)} = \begin{bmatrix} 0.9999996 & -0,000894269 & -4,44E-06 \\ 0.000894269 & 0.9999996 & 9.31E-06 \\ 4.43E-06 & -9.31E-06 & 1 \end{bmatrix}$$

$$\text{Translation}_{(\text{iteration}=1)} = \begin{bmatrix} 0.002443756 \\ -0.044463646 \\ -0.000178517 \end{bmatrix}$$

Runtime routine = 14674.54 s

$$\text{Rotation}_{(\text{iteration}=6)} = \begin{bmatrix} 0.999370169 & -0.035486131 & -5.95E-06 \\ 0.035486131 & 0.999370169 & 1.15E-05 \\ 5.54E-06 & -1.17E-05 & 1 \end{bmatrix}$$

$$\text{Translation}_{(\text{iteration}=6)} = \begin{bmatrix} 0.112855976 \\ -1.733340549 \\ -0.000145098 \end{bmatrix}$$

Runtime routine = 320394.18 s

$$\text{Rotation}_{(\text{iteration}=10)} = \begin{bmatrix} 0.9985364 & -0.054083795 & -6.28E-06 \\ 0.054083795 & 0.9985364 & 1.14E-05 \\ 5.66E-06 & -1.17E-05 & 1 \end{bmatrix}$$

$$\text{Translation}_{(\text{iteration}=10)} = \begin{bmatrix} 0.196380473 \\ -2.640073794 \\ -8.48E-05 \end{bmatrix}$$

Runtime routine = 811621.64 s

Total data– Transformation Matrix (4x4)

$$\text{Rotation}_{(\text{iteration}=1)} = \begin{bmatrix} 0.9999996 & -0,000894269 & -4,44\text{E}-06 & 0 \\ 0.000894269 & 0.9999996 & 9.31\text{E}-06 & 0 \\ 4.43\text{E}-06 & -9.31\text{E}-06 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$\text{Translation}_{(\text{iteration}=1)} = \begin{bmatrix} 0.002443756 \\ -0.044636646 \\ -0.000178517 \\ 0 \end{bmatrix}$$

$$\text{Rotation}_{(\text{iteration}=6)} = \begin{bmatrix} 0.999370169 & -0.035486131 & -5.95E-06 & 0 \\ 0.035486131 & 0.999370169 & 1.15E-05 & 0 \\ 5.54E-06 & -1.17E-05 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$\text{Translation}_{(\text{iteration}=6)} = \begin{bmatrix} 0.112855976 \\ -1.733340549 \\ -0.000145098 \\ 0 \end{bmatrix}$$

$$\text{Rotation}_{(\text{iteration}=10)} = \begin{bmatrix} 0.9985364 & -0.054083795 & -6.28E-06 & 0 \\ 0.054083795 & 0.9985364 & 1.14E-05 & 0 \\ 5.66E-06 & -1.17E-05 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$\text{Translation}_{(\text{iteration}=10)} = \begin{bmatrix} 0.196380473 \\ -2.640073794 \\ -8.48E-05 \\ 0 \end{bmatrix}$$