Lab 7

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Overview

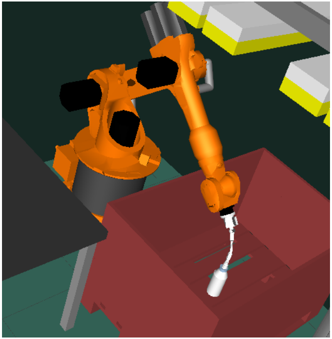
General Comments

ϵ

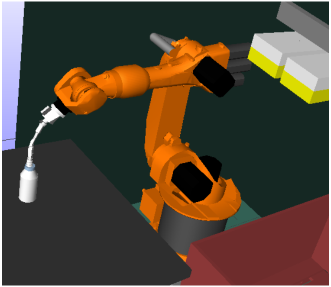
Conclusion

Programming exercise 7

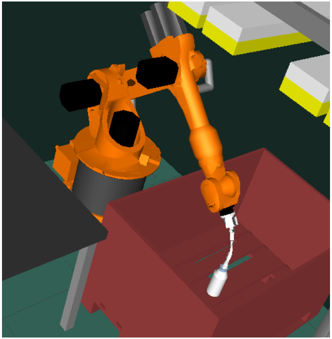
General Comments



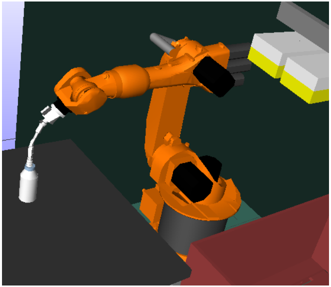
- Why does the robot make a big circle in all paths?



General Comments

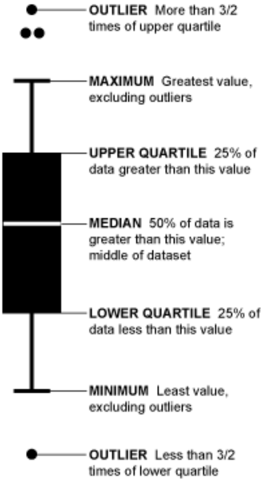


- Why does the robot make a big circle in all paths?
  - The base joint needs to turn 180° to reach the place position.



ϵ - Statistical Analysis

- Relevant parameters to look at:
  - Path length
  - Path size
  - Planning time
- Summary statistics
  - Mean, min, max, median, quantiles
  - Standard deviation or variance
- Visualization
  - Plots better than tables
  - Box plots, scatter plots, mean line with error bars

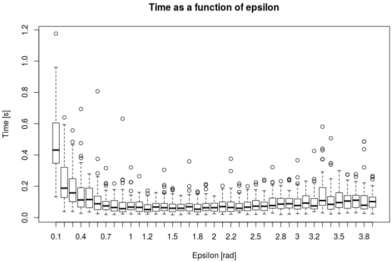


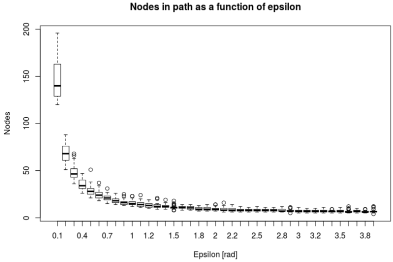
[1]

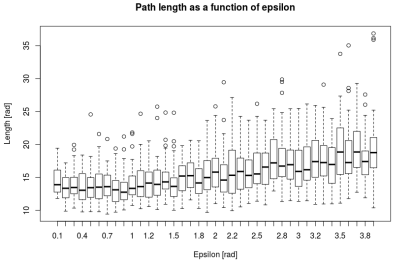
[1] Image borrowed from: `https://flowingdata.com/2008/02/15/how-to-read-and-use-a-box-and-whisker-plot/`

epsilon - Range

- ϵ from 0.1 to 4.0 in steps of 0.1







Conclusion

- ϵ
  - Trade-off between time and precision
  - Small ϵ
    - Long planning time
    - Many nodes in path
    - Shorter path
  - Large ϵ
    - Short planning time
    - Few nodes
    - Longer path
    - Might jump through obstacles

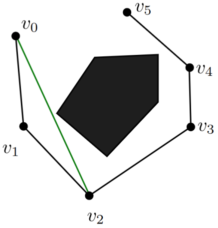
- Choice of ϵ is workcell specific
- Choose ϵ based on task

Programming exercise 7 - Path Pruning

Algorithm (Path Pruning)

Input: *Node path N.*
Output: *Node path N_{pr}.*
Procedure:

$N_{\text{pr}} \leftarrow N,\ i \leftarrow 0$
while $i < |N_{\text{pr}}| - 2$ **do**
  if $LP[v_i, v_{i+2}] \in \mathcal{C}_{\text{free}}$ **then**
    $N_{\text{pr}} \leftarrow N_{\text{pr}} \setminus \{v_{i+1}\}$
    if $i > 0$ **then**
      $i \leftarrow i - 1$
    end if
  else
    $i \leftarrow i + 1$
  end if
end while
return N_{pr}



$N_{\text{pr}} = \{v_0, v_1, v_2, v_3, v_4, v_5\},\ |N_{\text{pr}}| = 6$

$i = 0$

Programming exercise 7 - Path Pruning

- Tips for programming exercise 7:
  - Use the path that was generated in lab 6
  - Use the workcell from lab 6 (Kr16WallWorkCell)
  - Implement the path pruning algorithm:
    - Load the workcell
    - Loop through the Q configurations and check for collisions between the current node Q_i and Q_{i+2}
    - Delete node Q_{i+1} if there exist a collision-free path
    - Check the distance of the old path compared to the new one