

## RBE 450X – Homework 2

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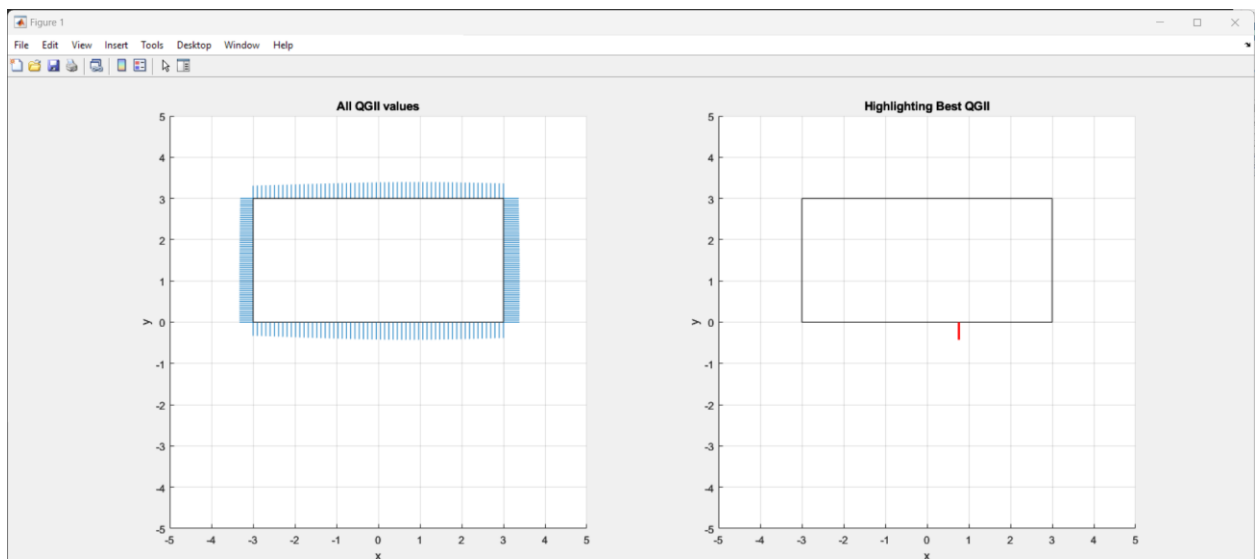
### PART 2

#### Grasp Matrix:

The grasp matrix, which describes how forces at the contact points map to torques and forces on the object, is printed three times for different metrics (QMSV, QVEW, and QGII). The matrices for the three cases are the same which suggests that the contact points or the orientation of the gripper relative to the object did not change between the computations for these metrics.

#### QGII (Grasp Isotropy Index):

- QGII measures the isotropy of the grasp, with a higher value suggesting a more uniform ability to resist forces from various directions.
- The highest QGII value is observed at the Bottom Edge (0.42679) which indicates that of the edges considered, a grip located at this edge would be the most isotropic or uniformly resistant to disturbances from different directions.
- The QGII value is least at the Left Edge (0.33048), implying this edge might not be the best location for achieving a uniform grip.



Best QGII at Right Edge: 0.39002

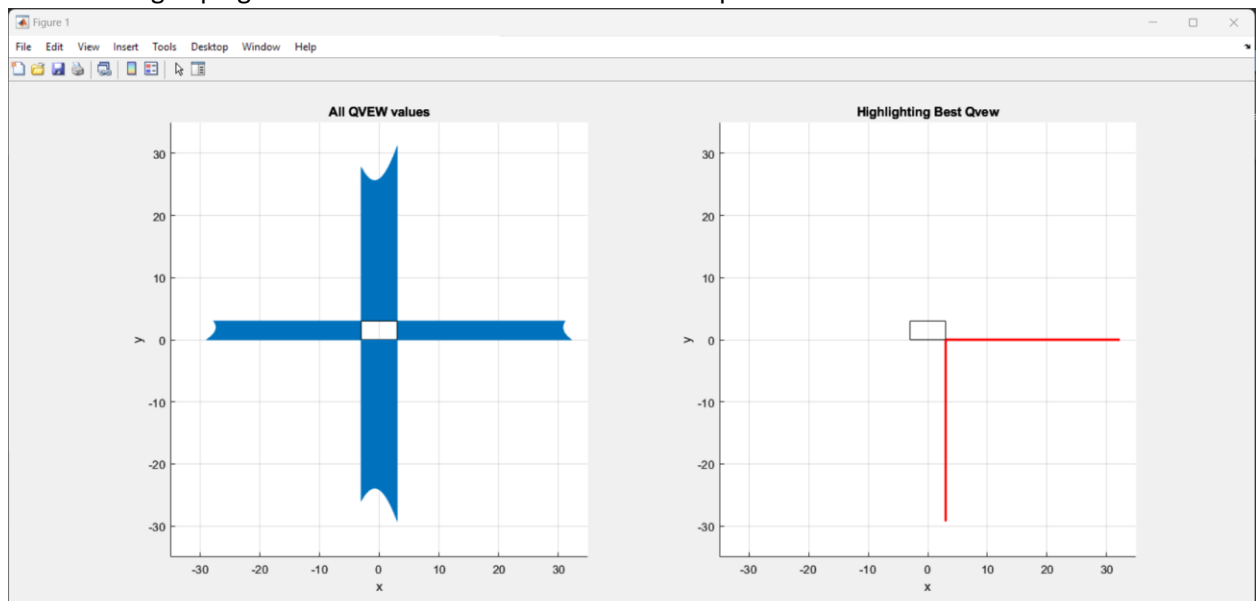
Best QGII at Left Edge: 0.33048

Best QGII at Top Edge: 0.39741

Best QGII at Bottom Edge: 0.42679

QVEW (Volume of the Ellipsoid in the Wrench Space):

- QVEW provides a measure of the overall grasp quality in terms of the volume of the ellipsoid in the wrench space. Higher values generally indicate better grasp quality.
- The Right Edge and Bottom Edge both have the highest QVEW value of 29.2404, suggesting that these two edges are approximately equal in terms of overall grasp quality.
- The Left Edge has the lowest QVEW value (25.9808) indicating it might not be the most optimal location for grasping in terms of the volume of the wrench space.



Best QVEW at Right Edge: 29.2404

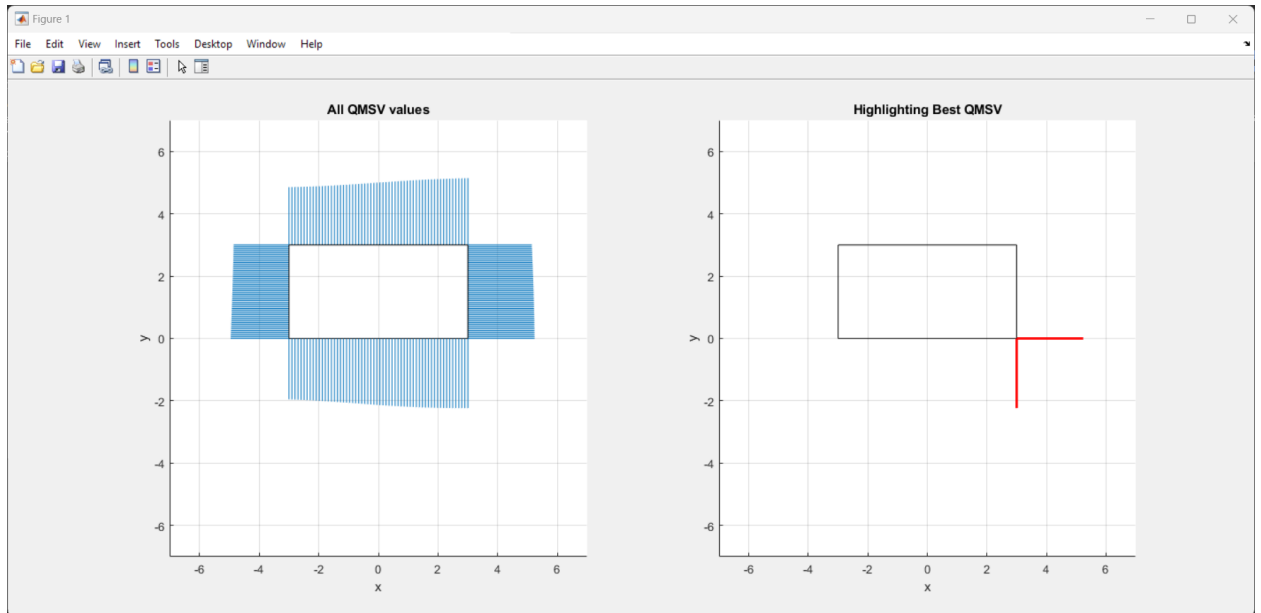
Best QVEW at Left Edge: 25.9808

Best QVEW at Top Edge: 28.1957

Best QVEW at Bottom Edge: 29.2404

QMSV (Minimum Singular Value):

- QMSV measures the weakest force that the grasp can resist, so a higher value indicates a stronger grasp.
- Similar to QVEW, both the Right Edge and Bottom Edge have the highest QMSV value (2.2342), implying a more robust grip at these edges when subjected to disturbances.
- The Left Edge again scores the lowest with a QMSV value of 1.9517.



Best QMSV at Right Edge: 2.2342  
Best QMSV at Left Edge: 1.9517  
Best QMSV at Top Edge: 2.1417  
Best QMSV at Bottom Edge: 2.2342  
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### Observations:

- The Bottom Edge seems to be the most preferable location for grasping the object given its high values across all three metrics (QMSV, QVEW, and QGII).
- The Right Edge also appears to be a good choice based on its QMSV and QVEW values.
- The Left Edge consistently scored the lowest in all three metrics, making it the least preferred edge for a grip.
- These metrics provide insights into the stability and quality of the grasp at various points, which can be critical for applications like robotic manipulation or prosthetics. Making decisions based on such metrics can lead to safer and more reliable grasping operations.