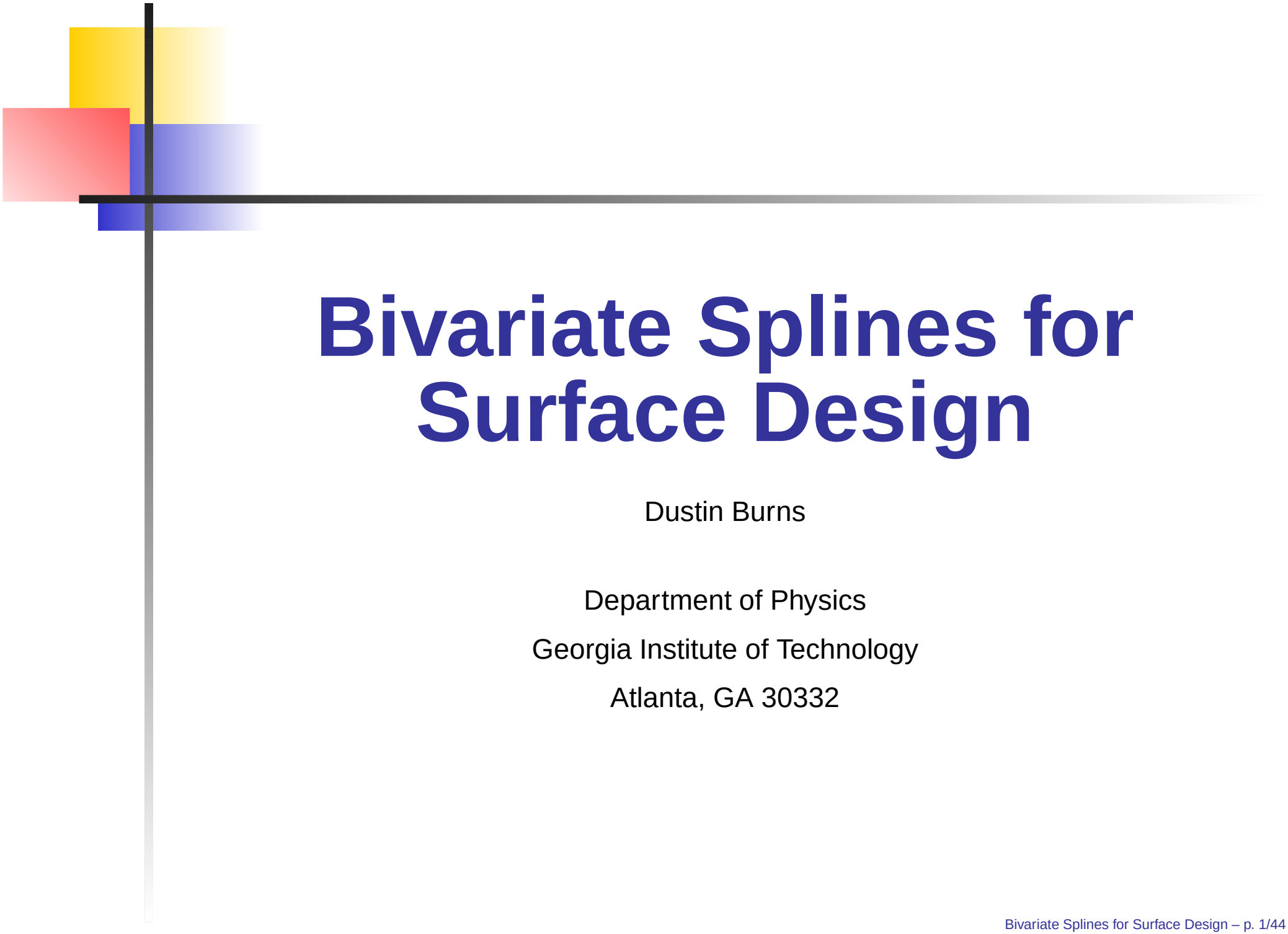


# Bivariate Splines for Surface Design

Dustin Burns

Department of Physics

Georgia Institute of Technology

Atlanta, GA 30332

# Objectives

- Determine the best method for fitting a spline to a data set.

# Objectives

- Determine the best method for fitting a spline to a data set.
- Describe each method mathematically: Minimal Energy Interpolatory Method, L1 Norm Interpolatory Method, Minimal Roughness Interpolatory Method, Minimal Triharmonic Interpolatory Method, Minimal Surface Area Method

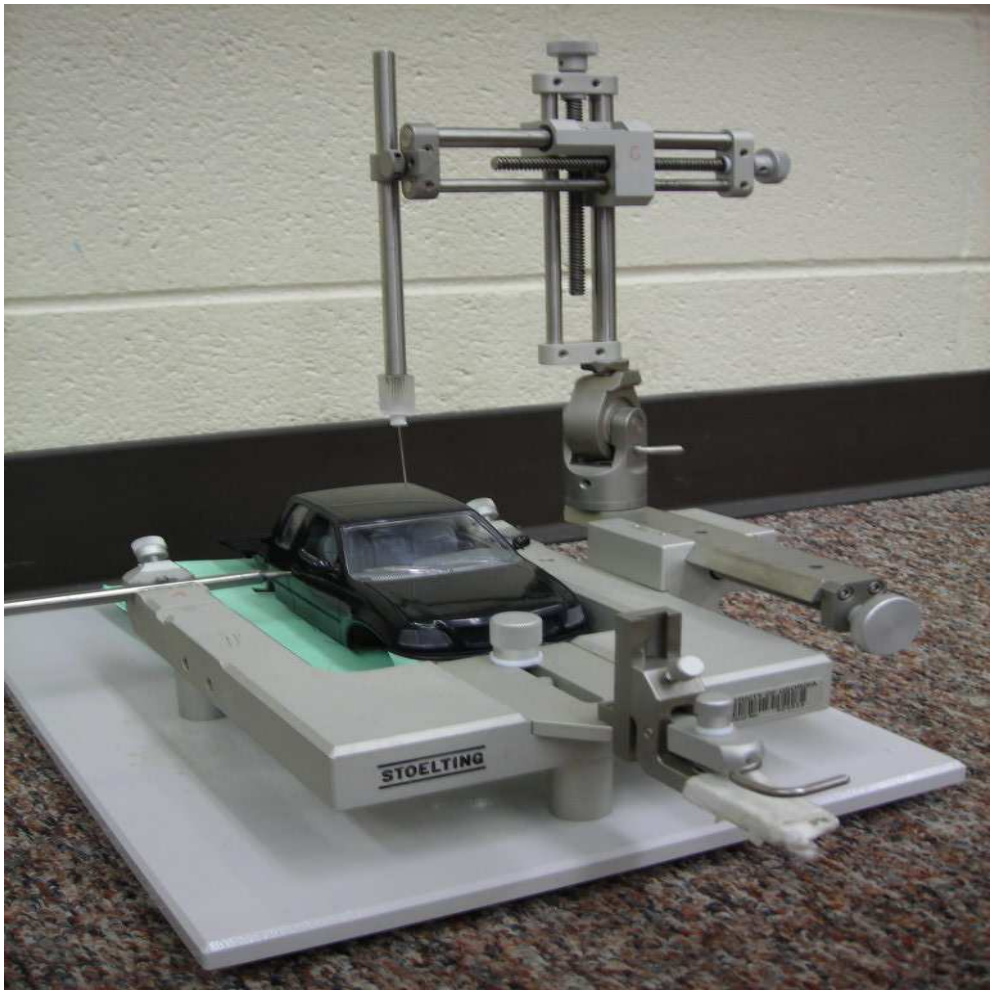
# Objectives

- Determine the best method for fitting a spline to a data set.
- Describe each method mathematically: Minimal Energy Interpolatory Method, L1 Norm Interpolatory Method, Minimal Roughness Interpolatory Method, Minimal Triharmonic Interpolatory Method, Minimal Surface Area Method
- Gather data from model truck using apparatus.

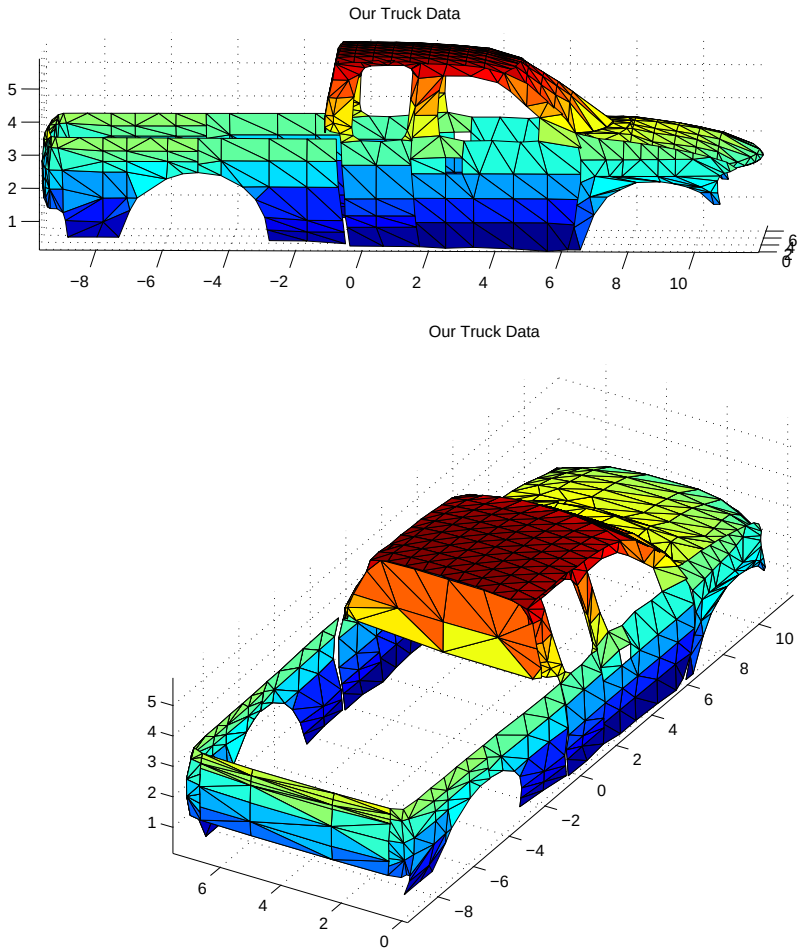
# Objectives

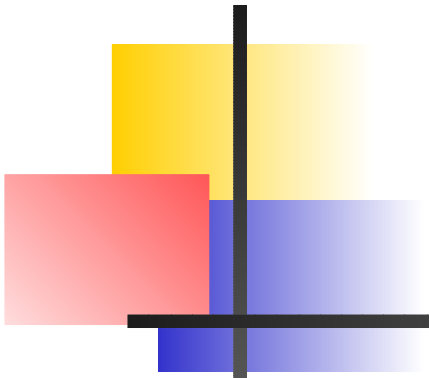
- Determine the best method for fitting a spline to a data set.
- Describe each method mathematically: Minimal Energy Interpolatory Method, L1 Norm Interpolatory Method, Minimal Roughness Interpolatory Method, Minimal Triharmonic Interpolatory Method, Minimal Surface Area Method
- Gather data from model truck using apparatus.
- Compare global and local graphs of truck splines.

# Gathering Data



# Our Truck Data





# Comparing Methods

- Minimal Energy Interpolatory Method

# Comparing Methods

- Minimal Energy Interpolatory Method
- L1 Spline Interpolatory Method

# Comparing Methods

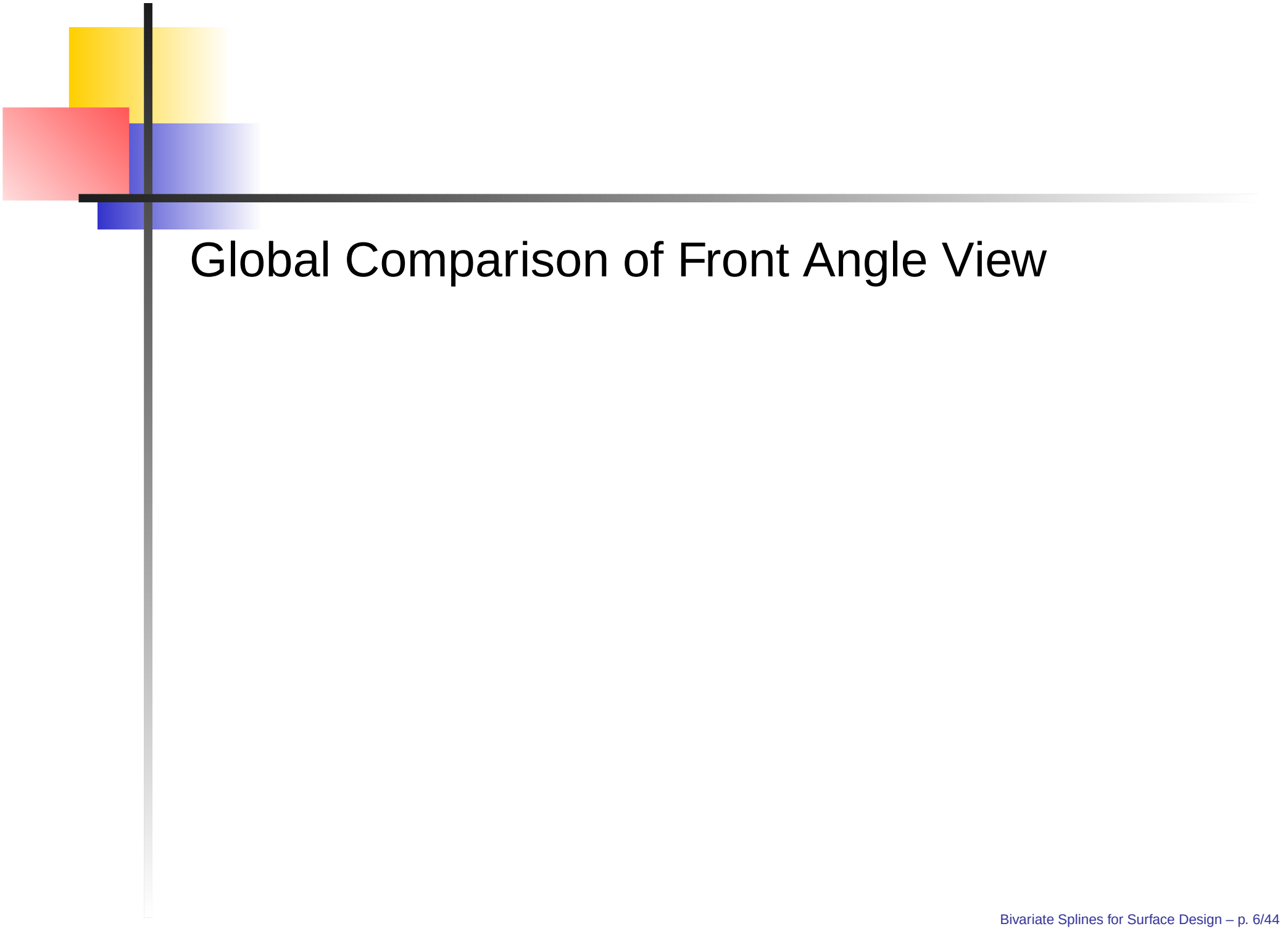
- Minimal Energy Interpolatory Method
- L1 Spline Interpolatory Method
- Minimal Roughness Interpolatory Method

# Comparing Methods

- Minimal Energy Interpolatory Method
- L1 Spline Interpolatory Method
- Minimal Roughness Interpolatory Method
- Minimal Triharmonic Interpolatory Method

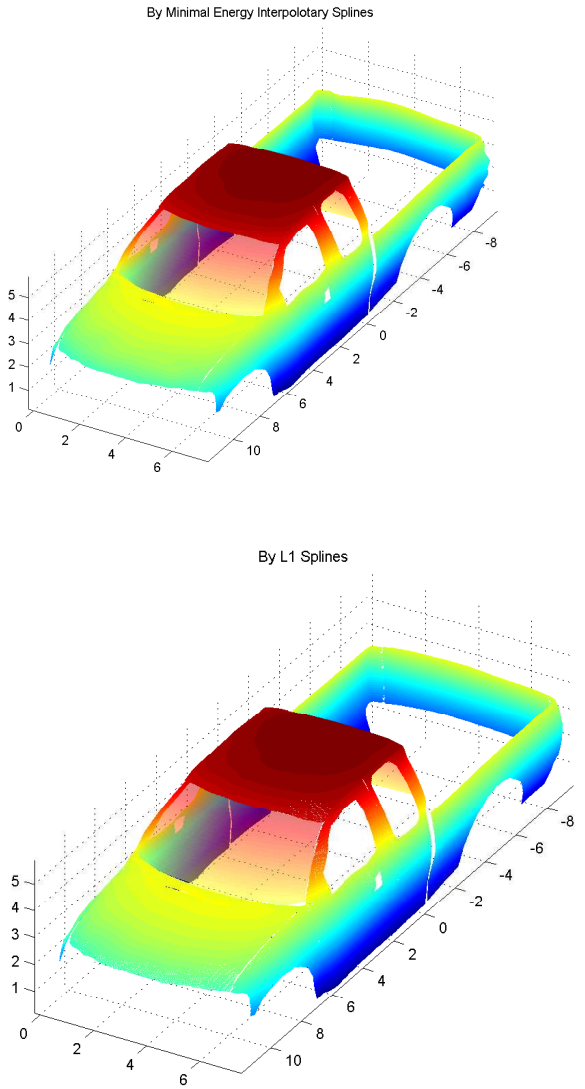
# Comparing Methods

- Minimal Energy Interpolatory Method
- L1 Spline Interpolatory Method
- Minimal Roughness Interpolatory Method
- Minimal Triharmonic Interpolatory Method
- Minimal Surface Area Method

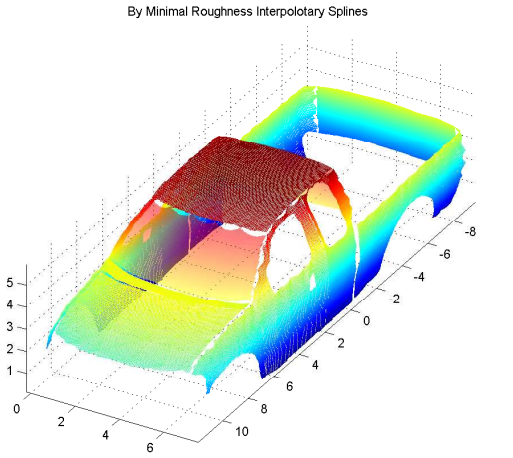


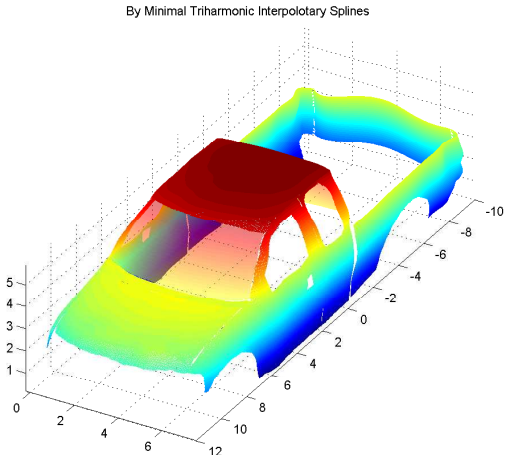
# Global Comparison of Front Angle View

# Minimal Energy and L1 Norm

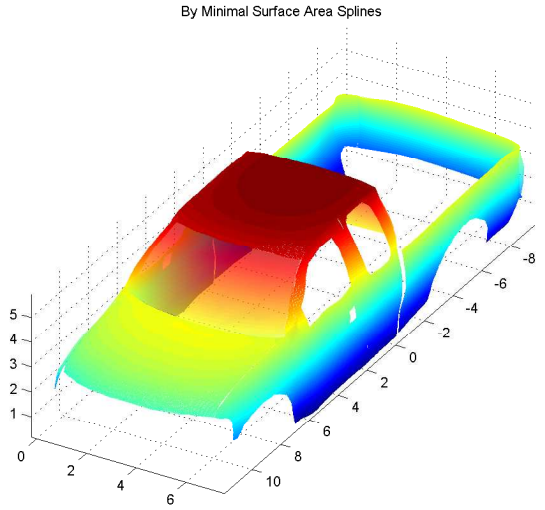


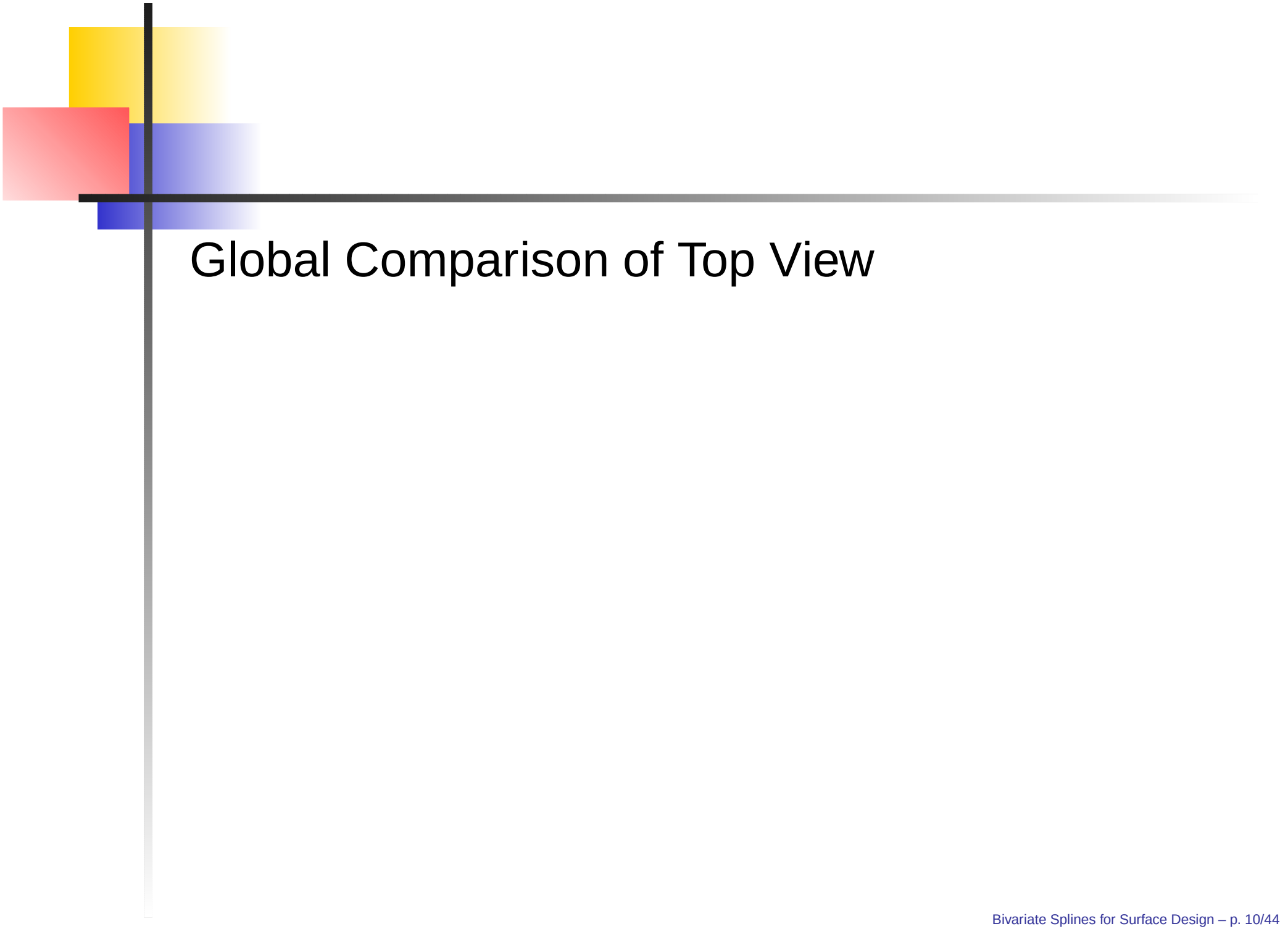
# Minimal Roughness and Minimal Triharmonic



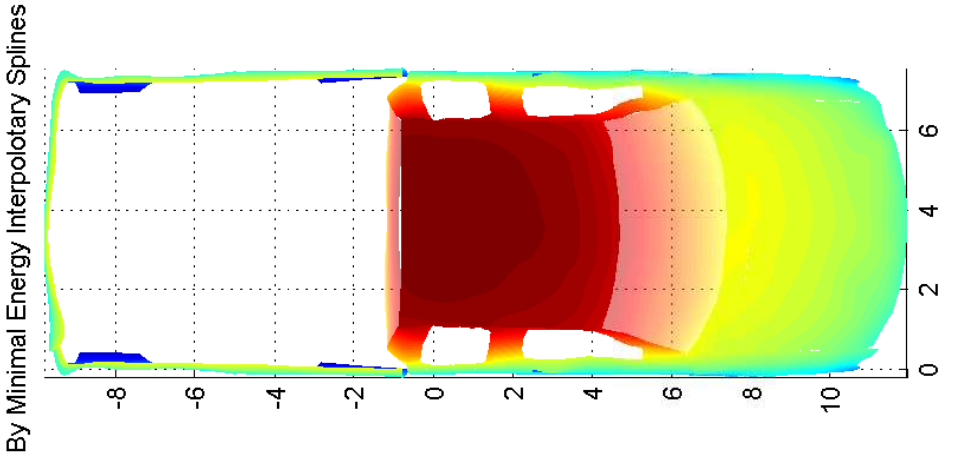
# Minimal Surface Area



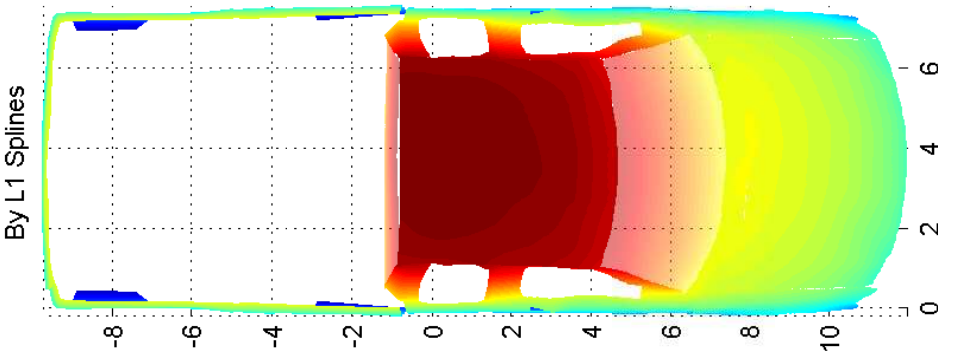


# Global Comparison of Top View

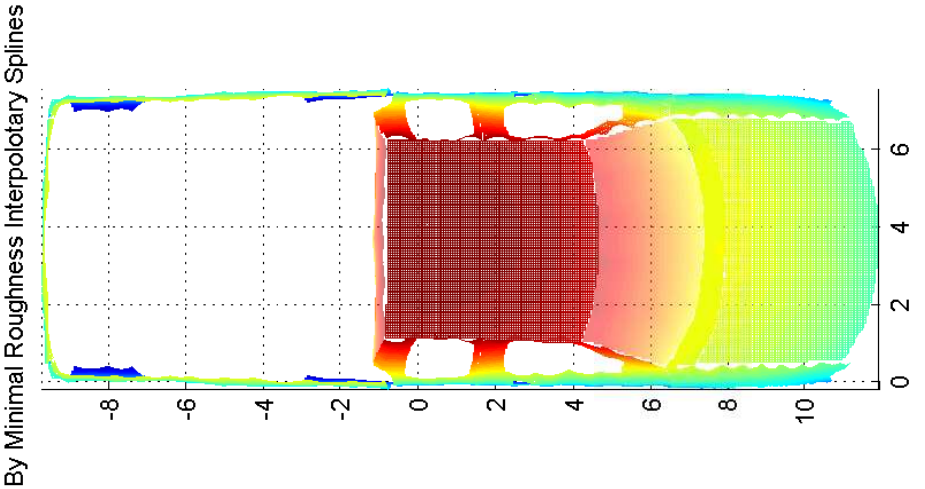
# Minimal Energy



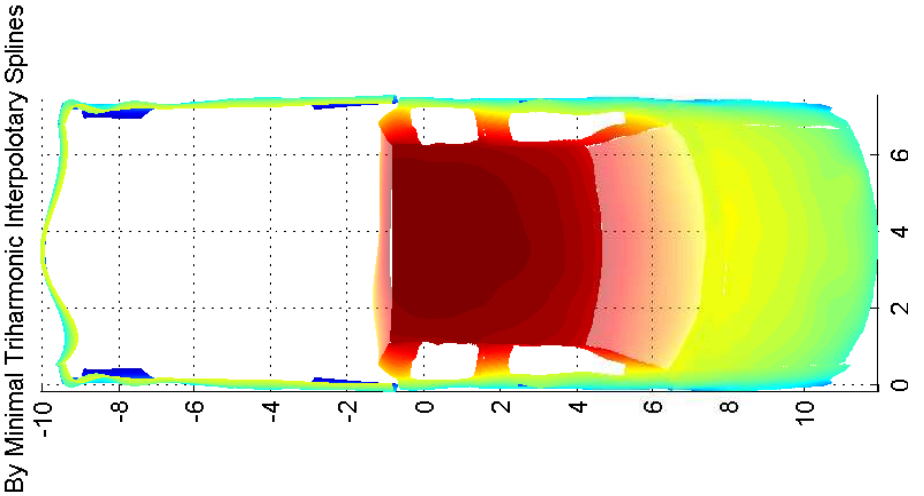
# L1 Norm



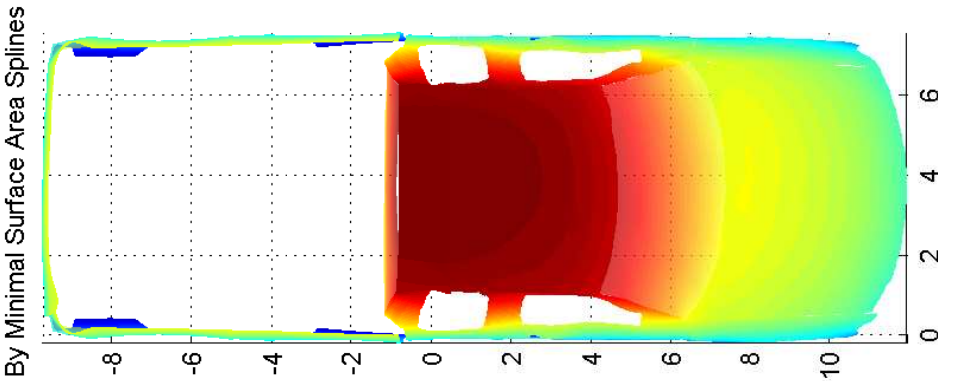
# Minimal Roughness

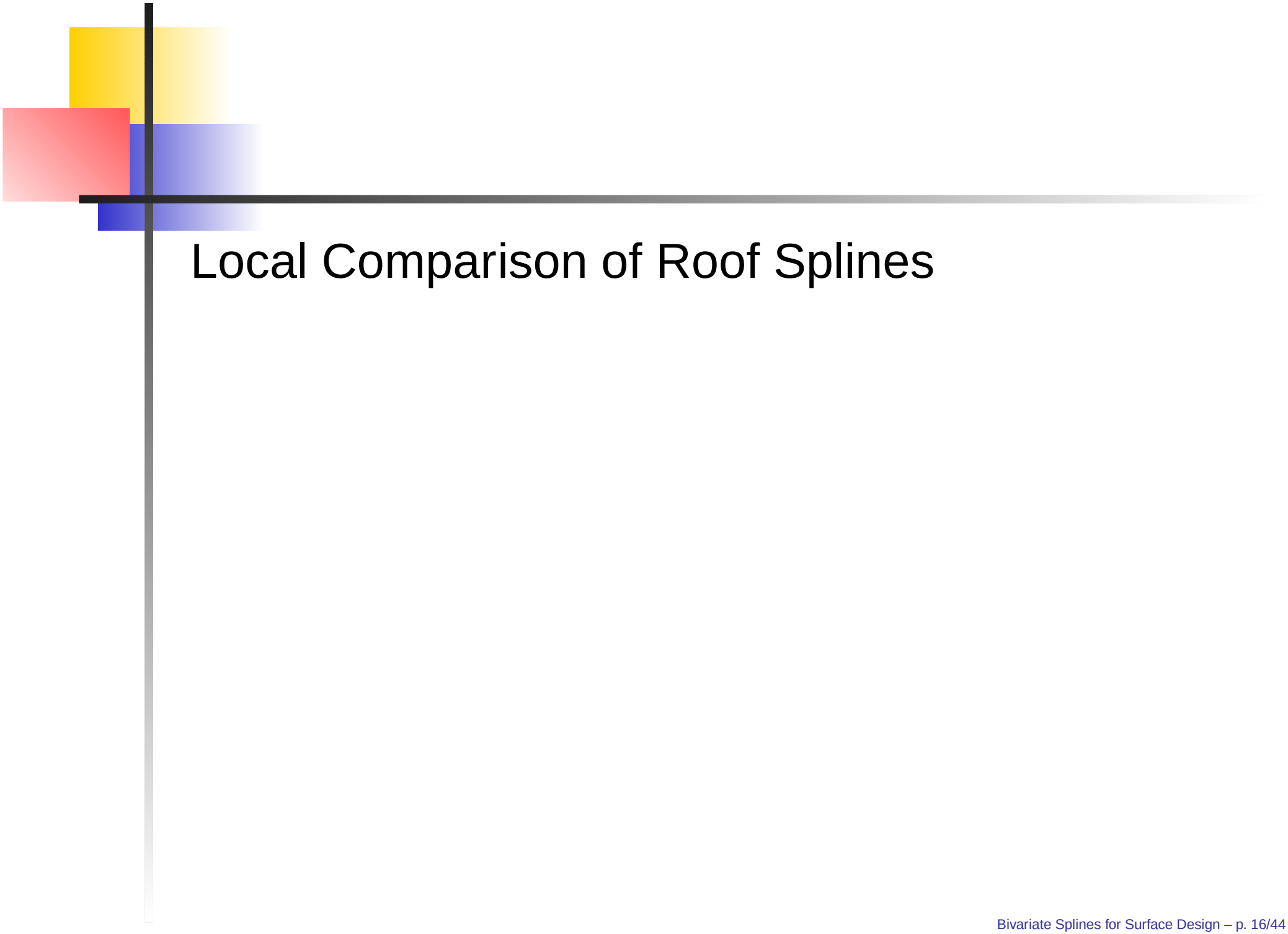


# Minimal Triharmonic



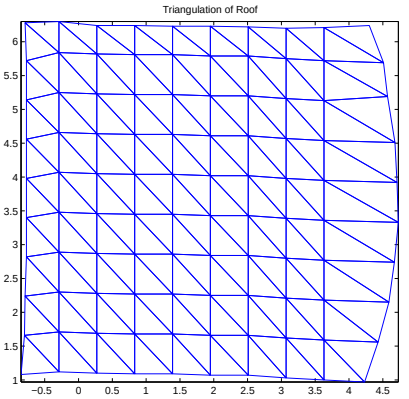
# Minimal Surface Area



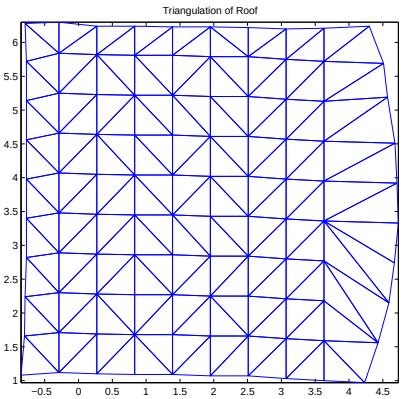


# Local Comparison of Roof Splines

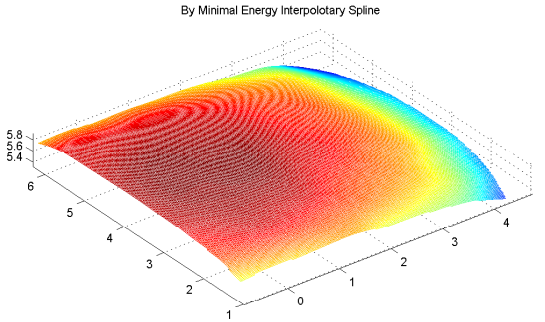
# Triangulations of Roof Splines For all methods except MSA

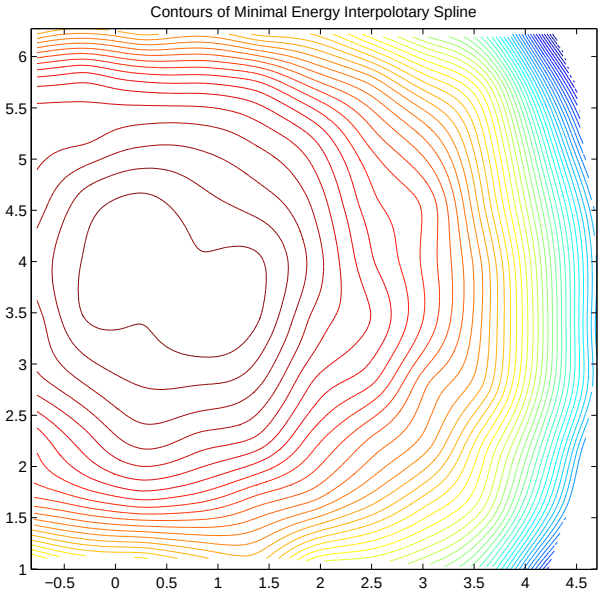



For MSA method

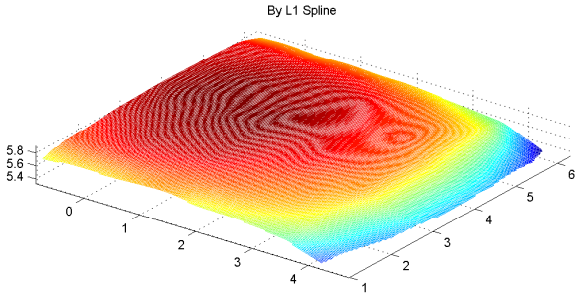


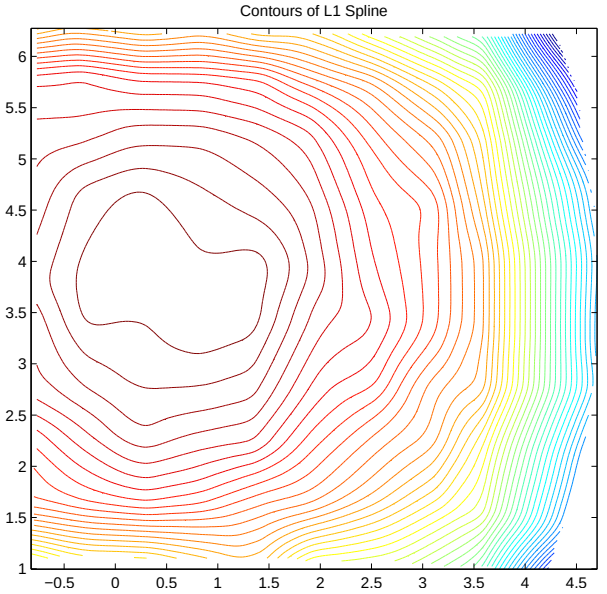
# Minimal Energy Interpolatory Method



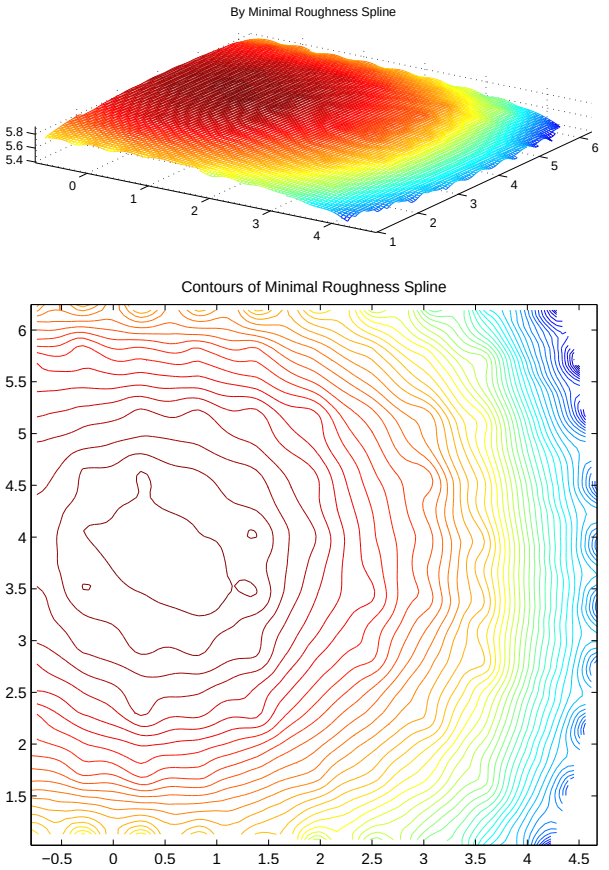



# L1 Norm Interpolatory Method

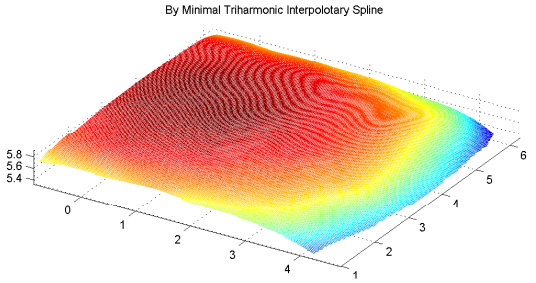


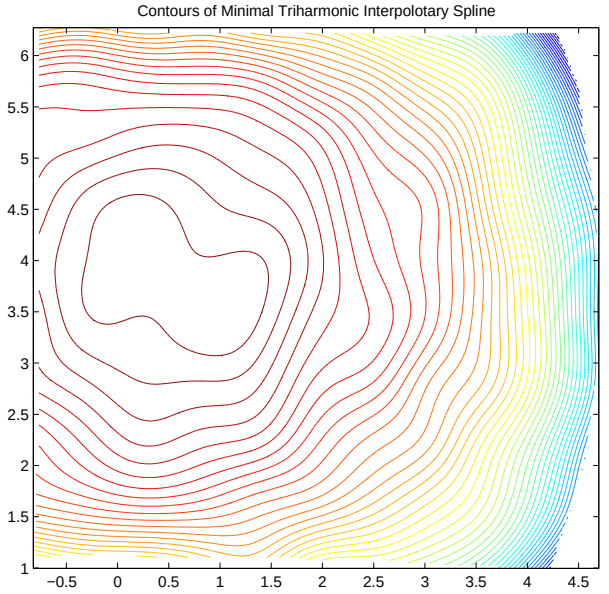



# Minimal Roughness Interpolatory Method

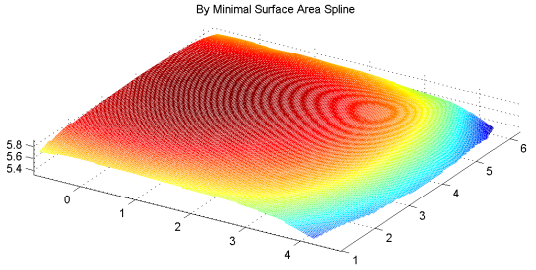


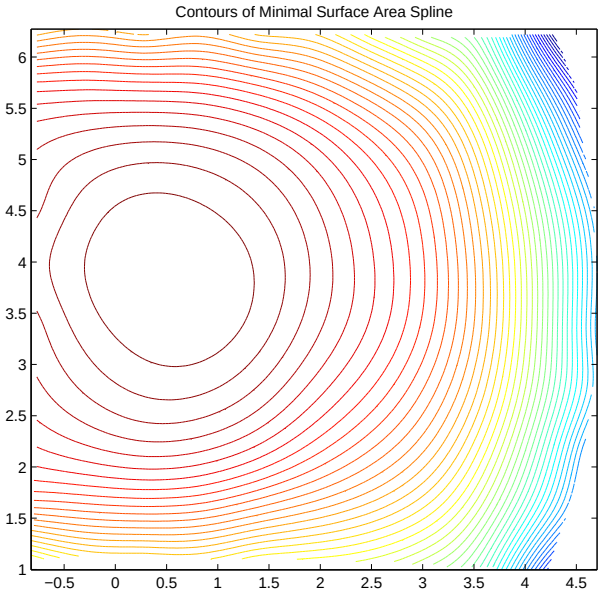
# Minimal Triharmonic Interpolatory Method



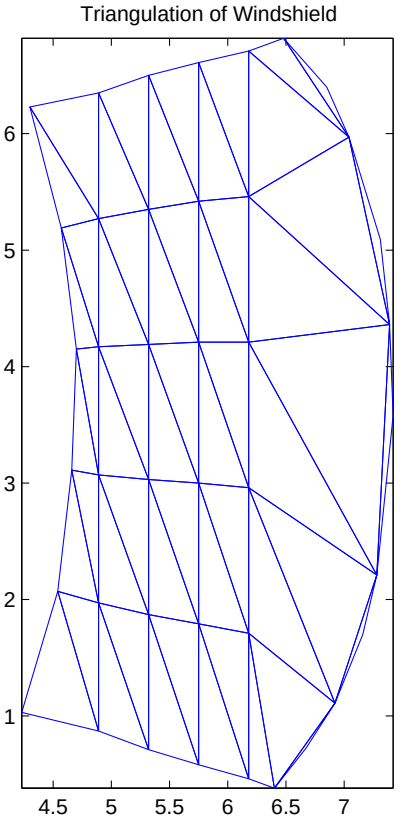
# Minimal Surface Area Method



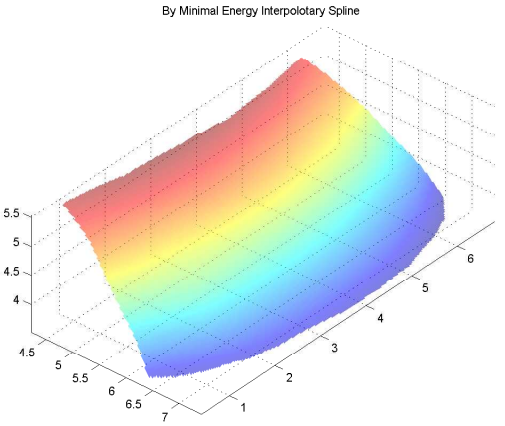



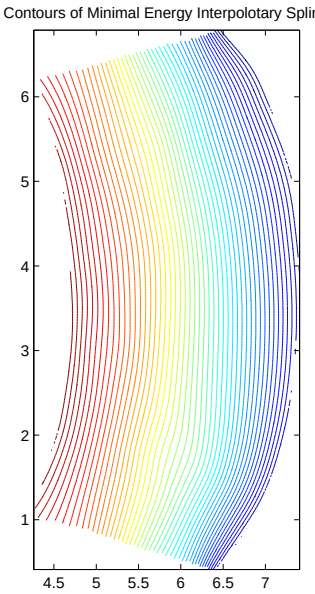
# Local Comparison of Windshield Splines

# Triangulation of Windshield Splines

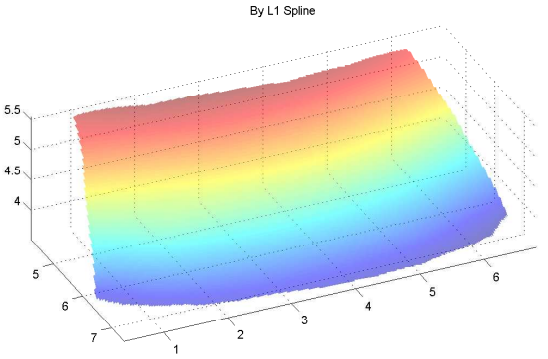


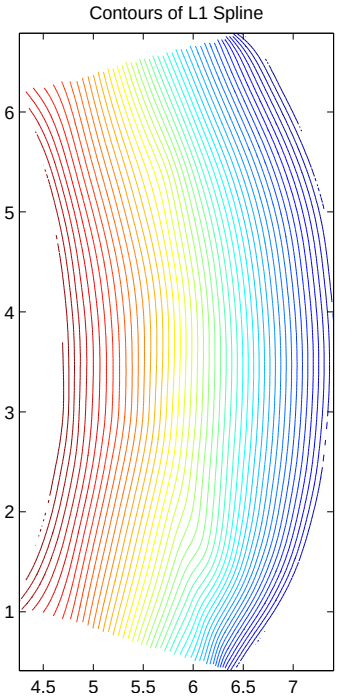
# Minimal Energy Interpolatory Method



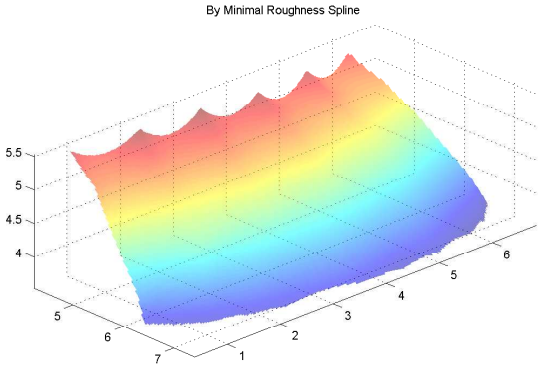



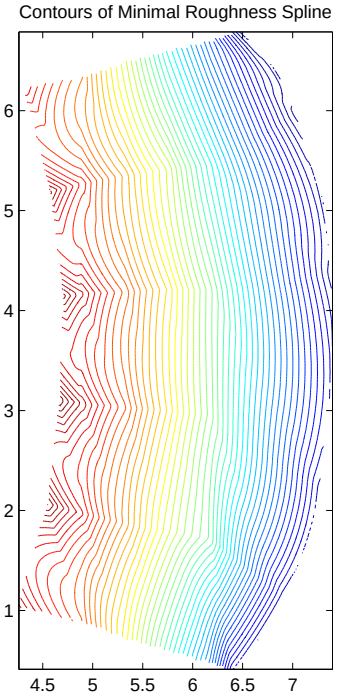
# L1 Norm Interpolatory Method



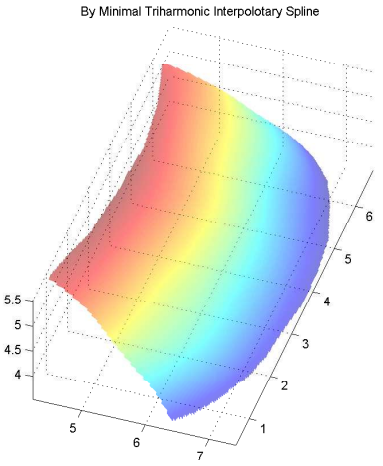



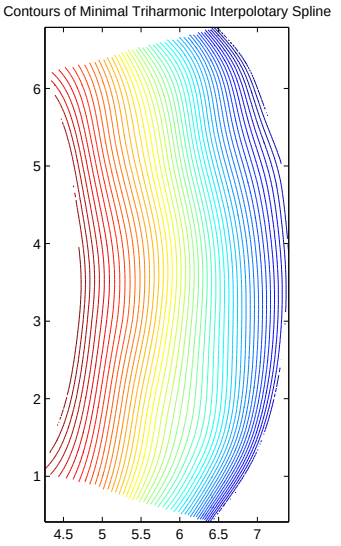
# Minimal Roughness Interpolatory Method



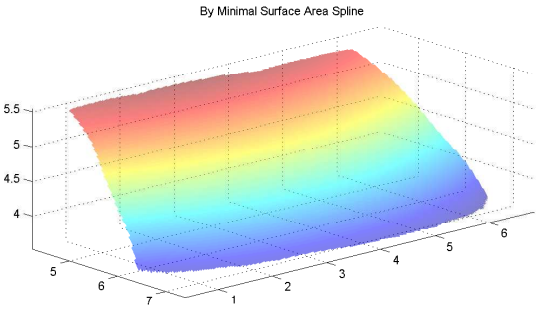



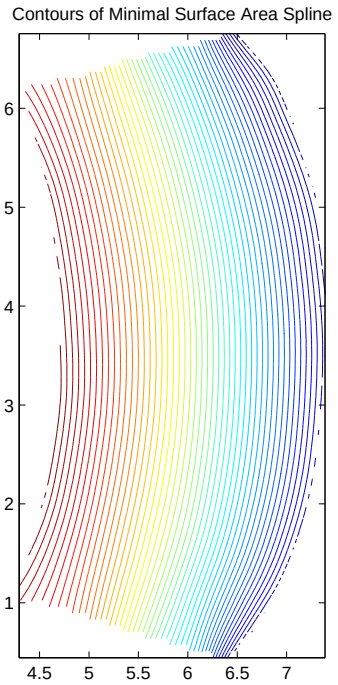
# Minimal Triharmonic Interpolatory Method

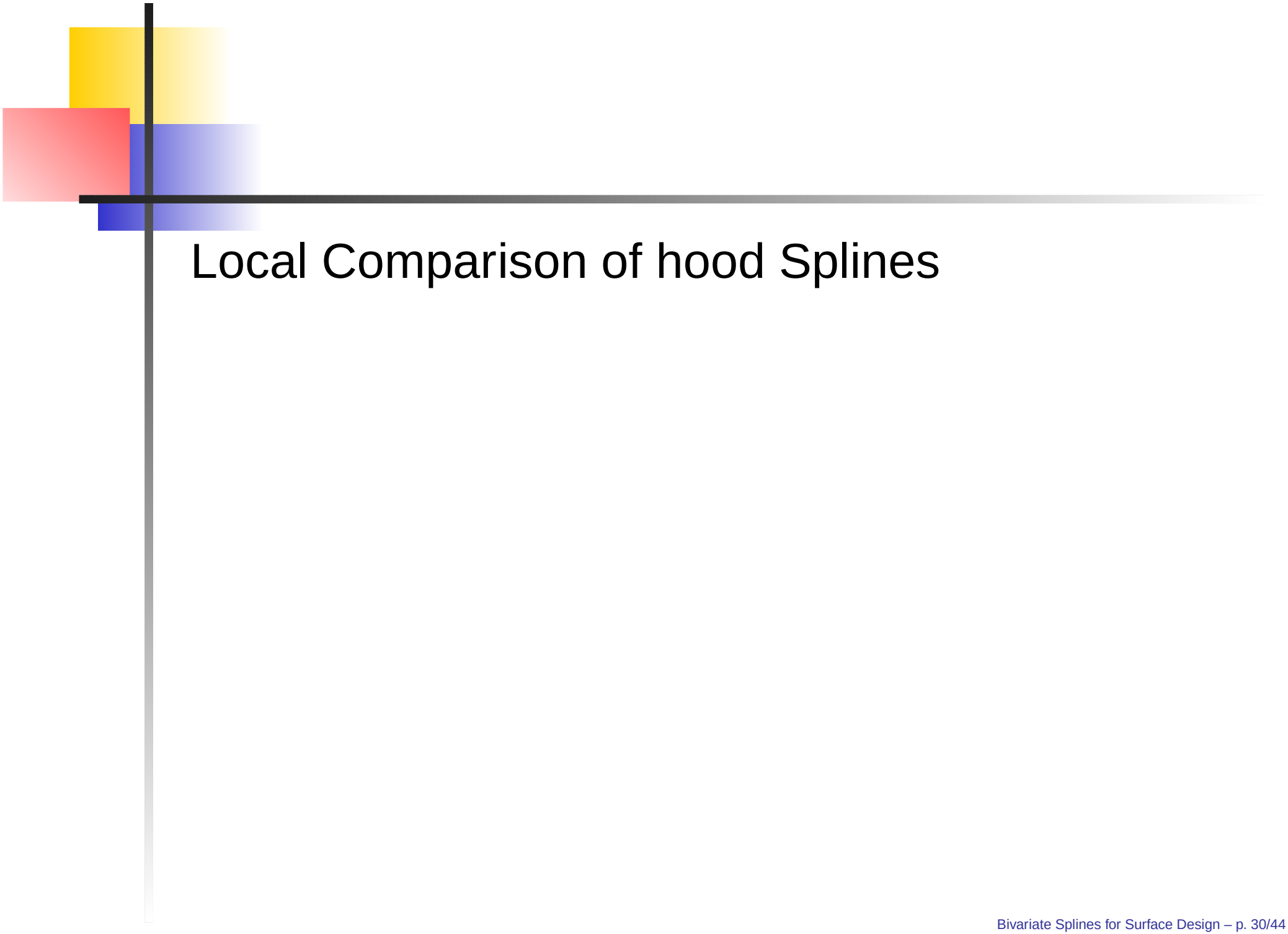


# Minimal Surface Area Method

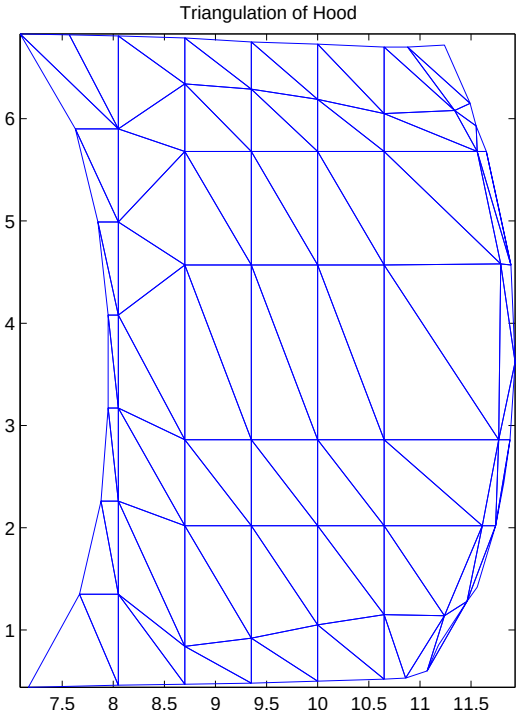


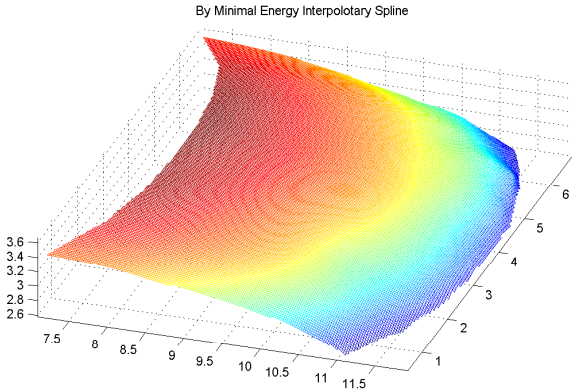


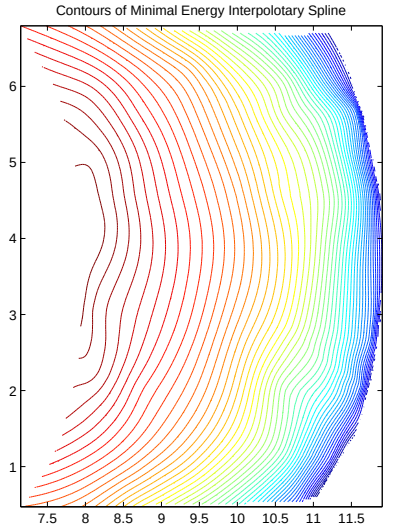
# Local Comparison of hood Splines

# Triangulation of Hood Splines

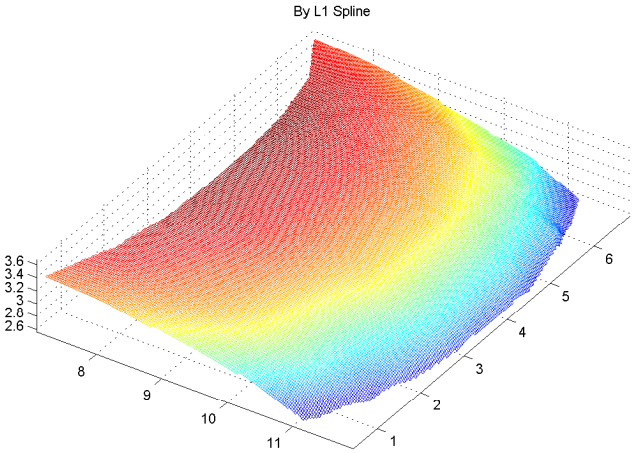


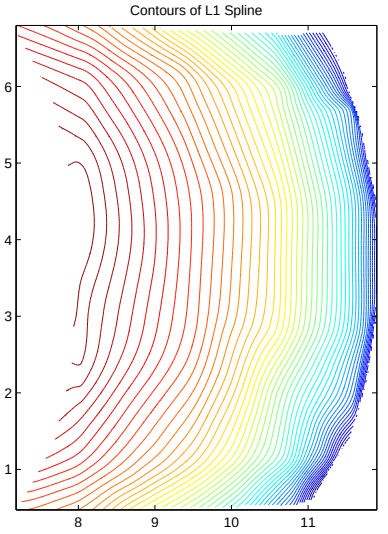
# Minimal Energy Interpolatory Method



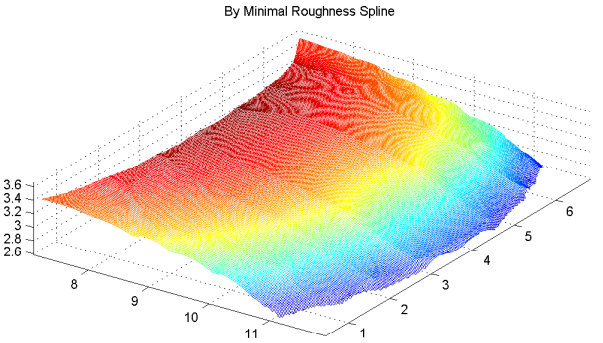



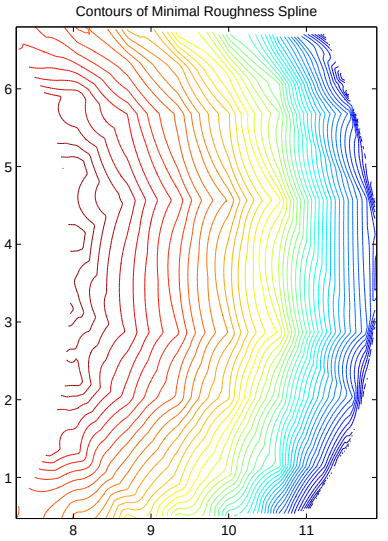
# L1 Norm Interpolatory Method



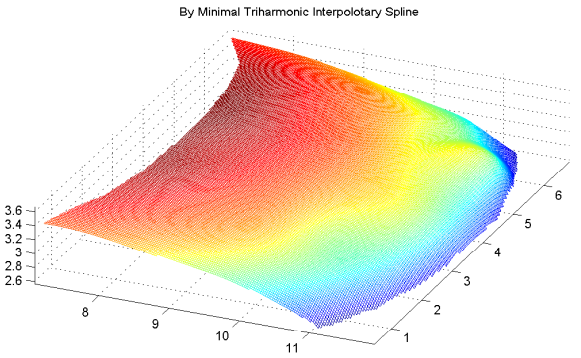



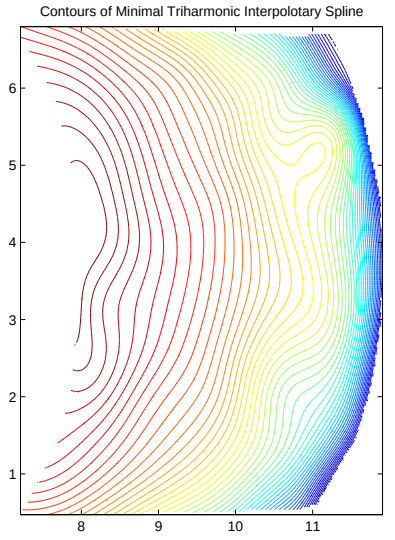
# Minimal Roughness Interpolatory Method



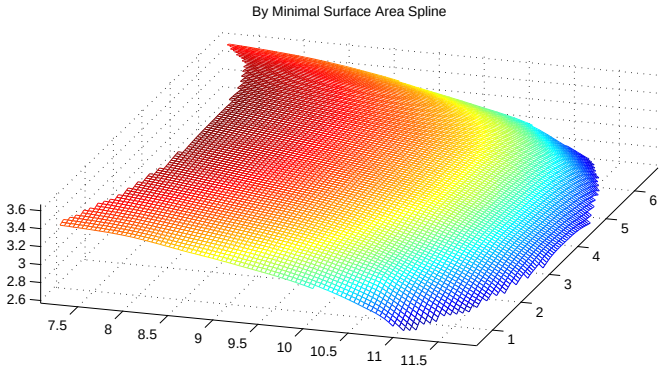



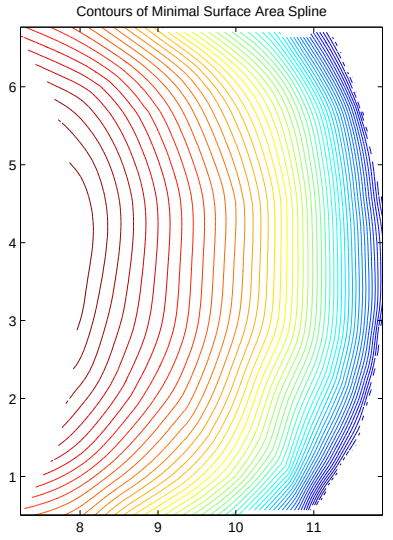
# Minimal Triharmonic Interpolatory Method

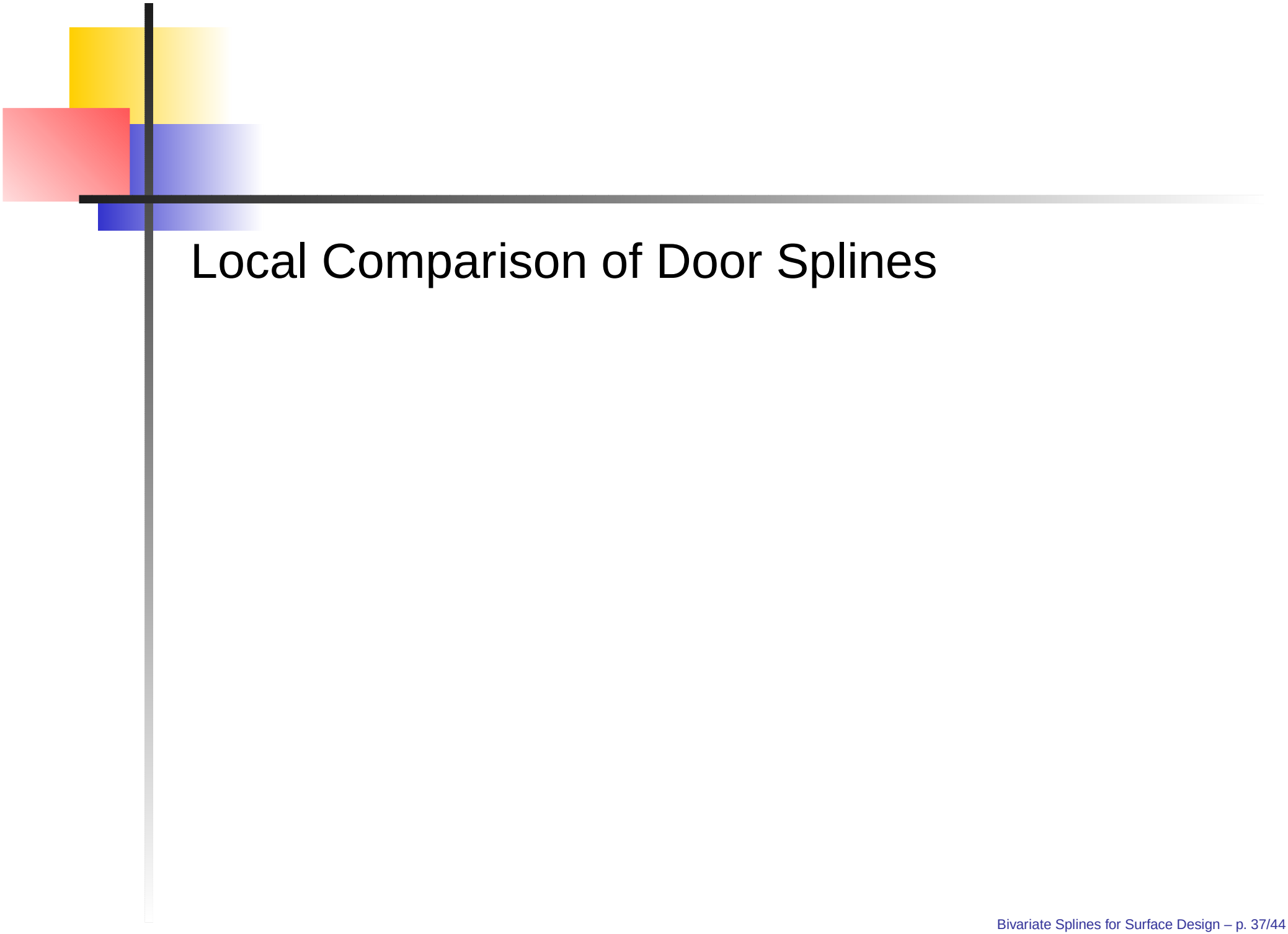


# Minimal Surface Area Method

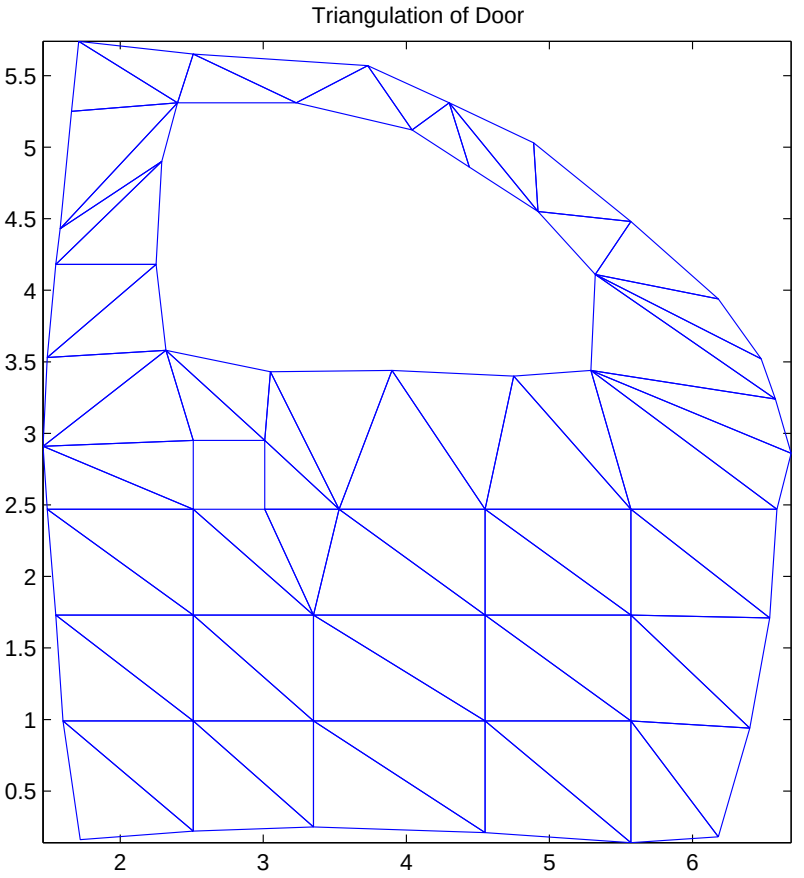


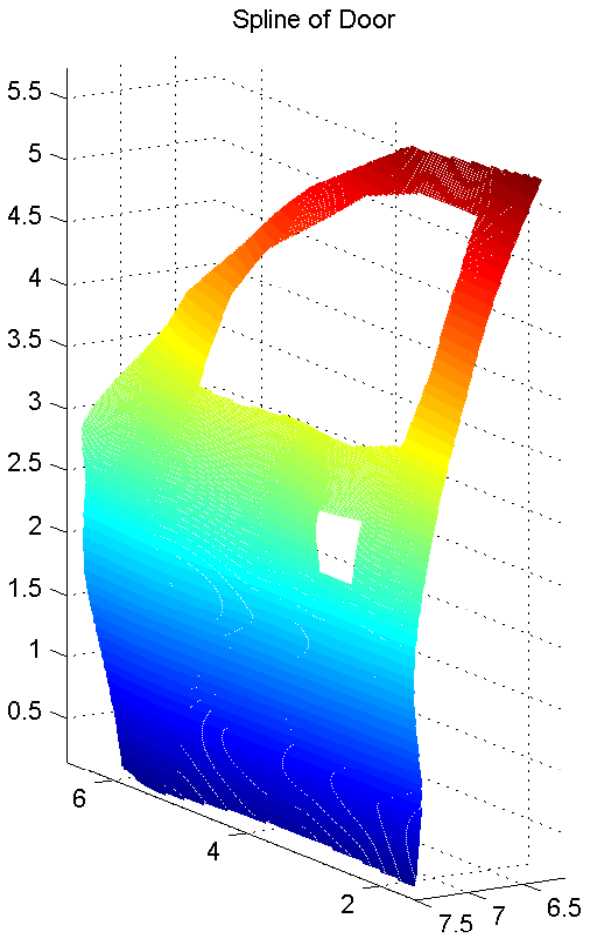


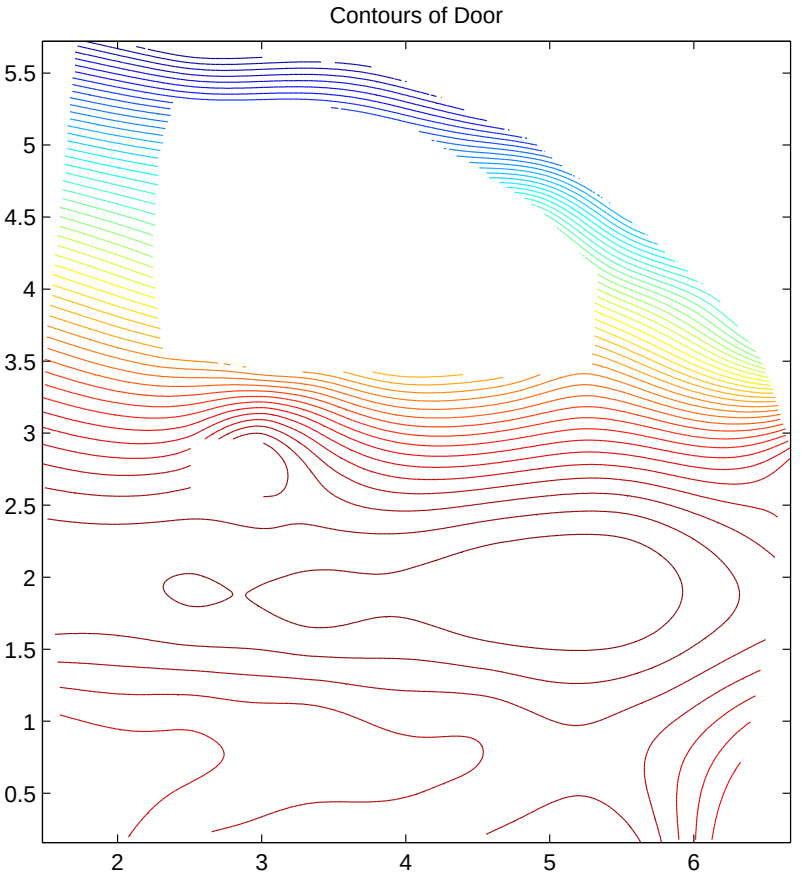
# Local Comparison of Door Splines

# Triangulation of Door Splines

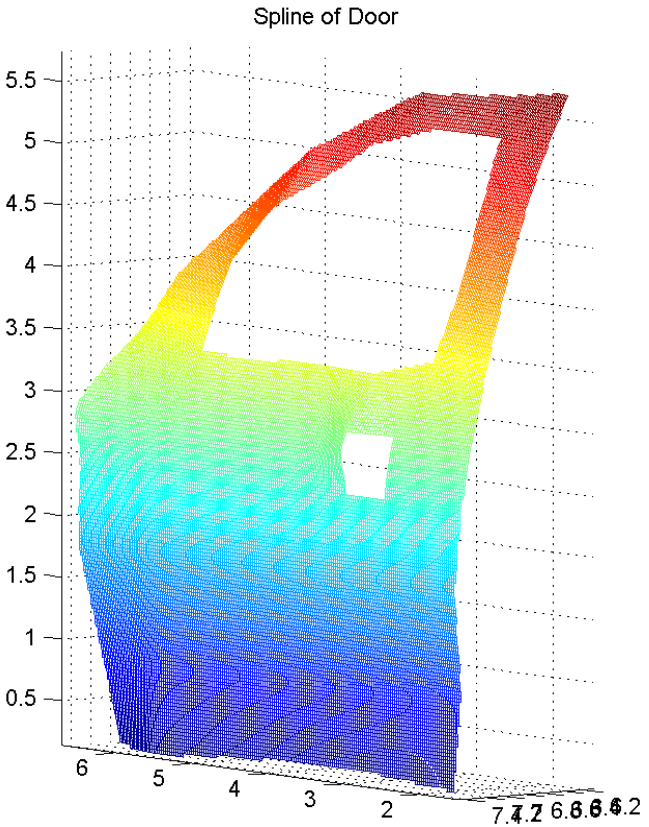


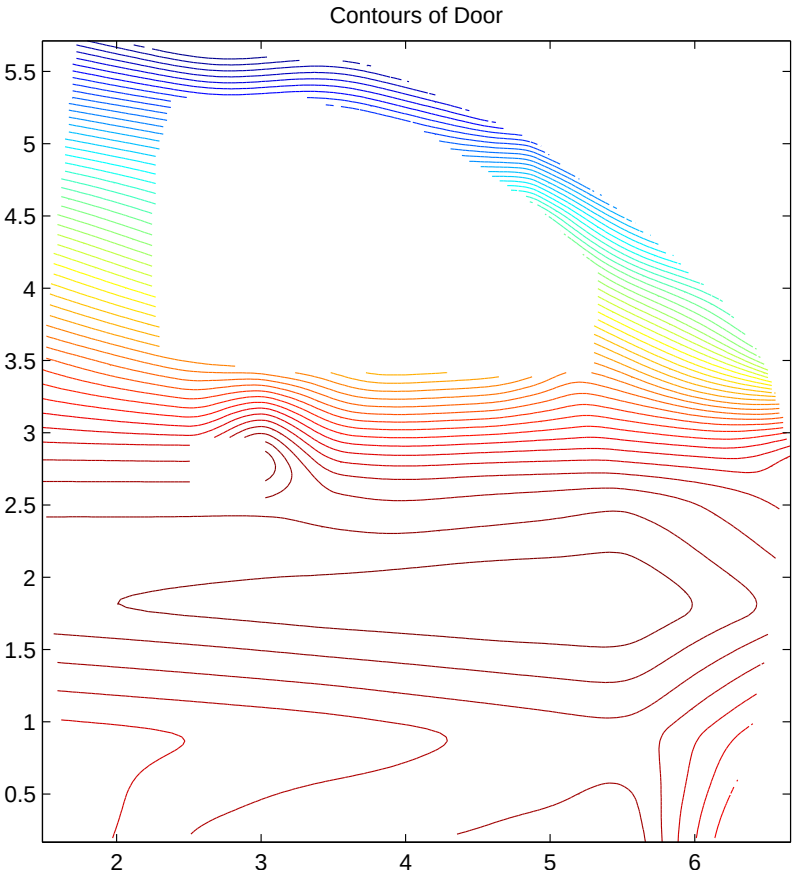
# Minimal Energy Interpolatory Method



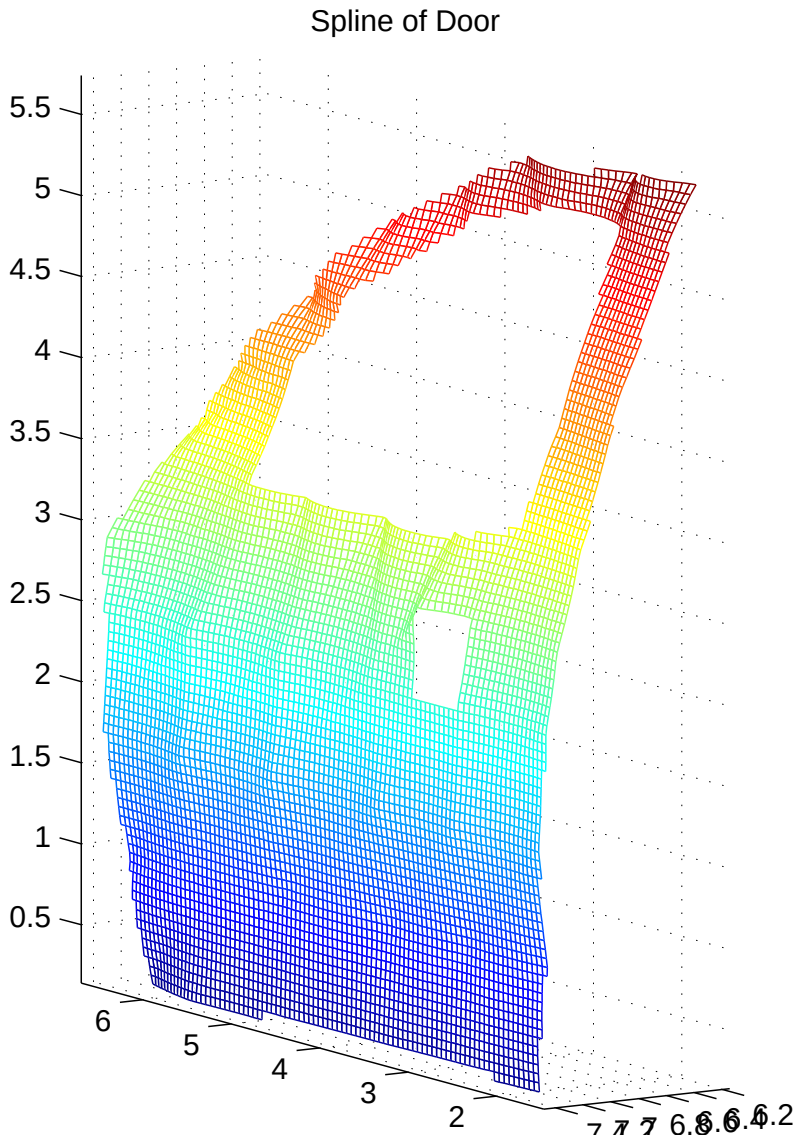



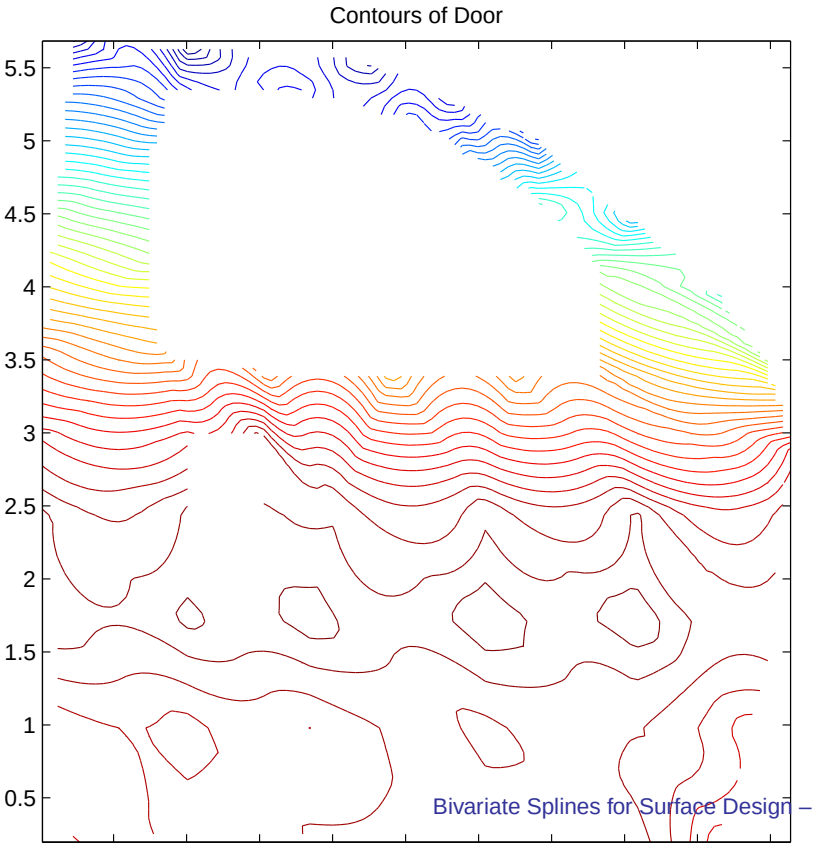
# L1 Spline Interpolatory Method



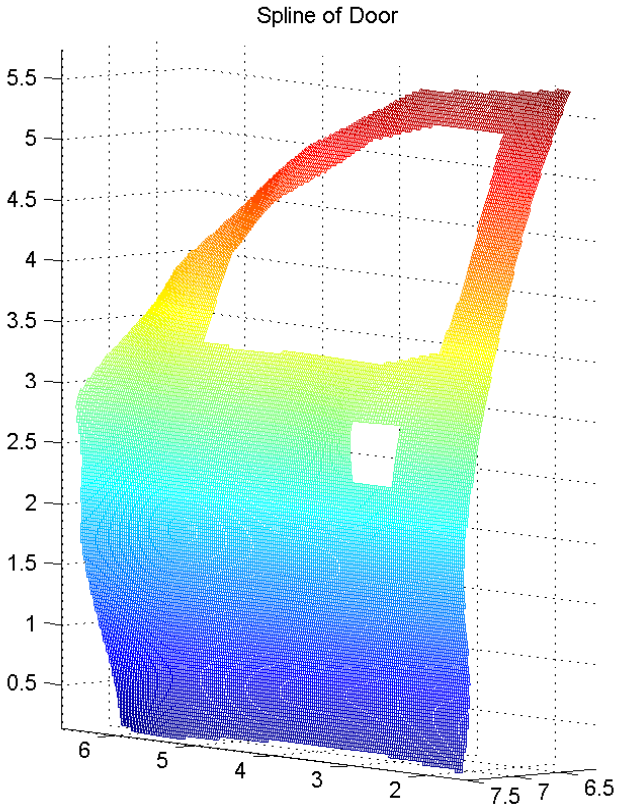



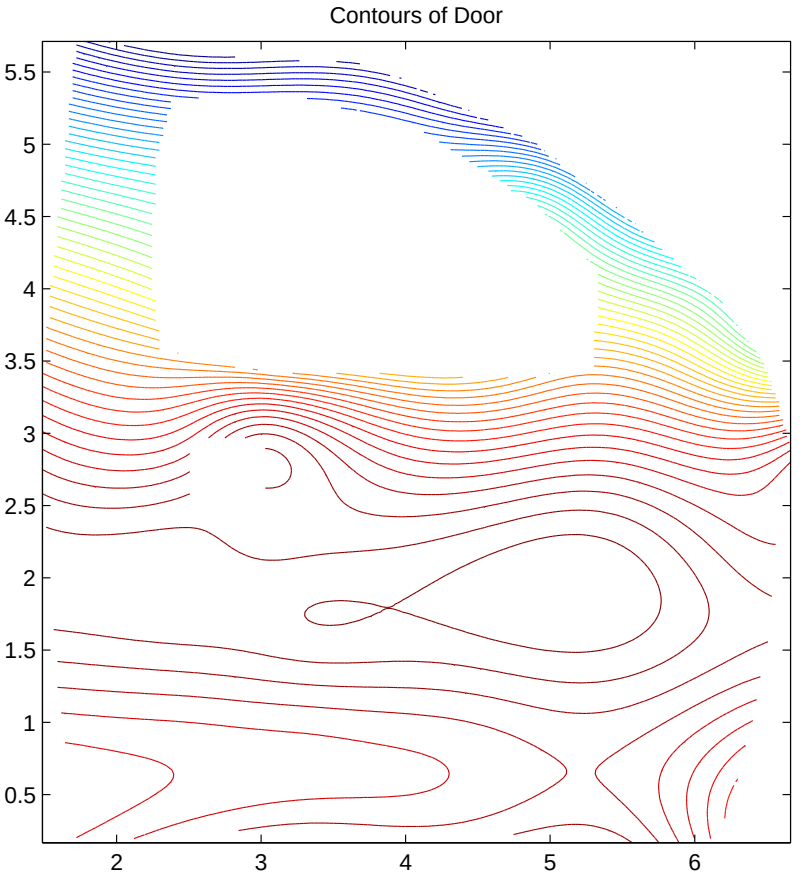
# Minimal Roughness Interpolatory Method



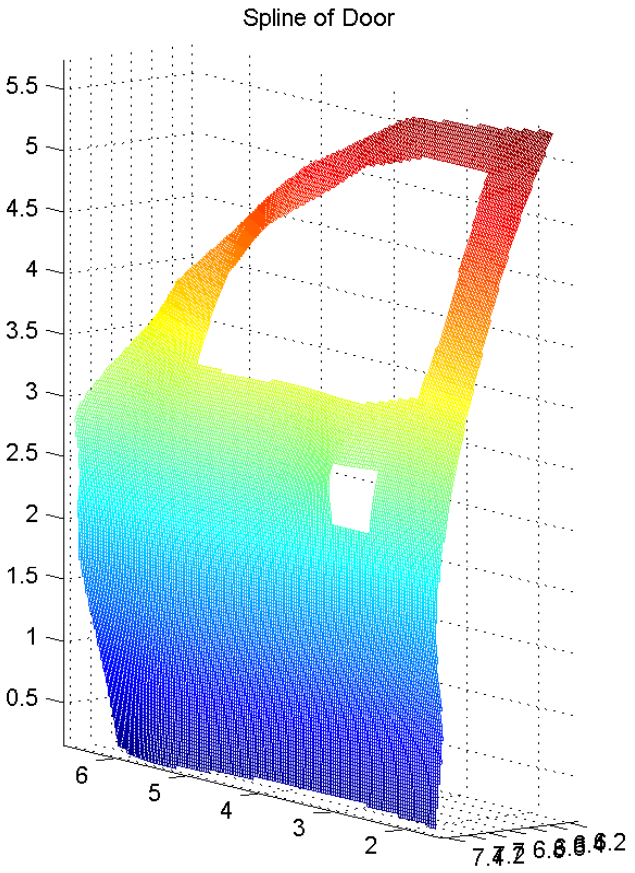



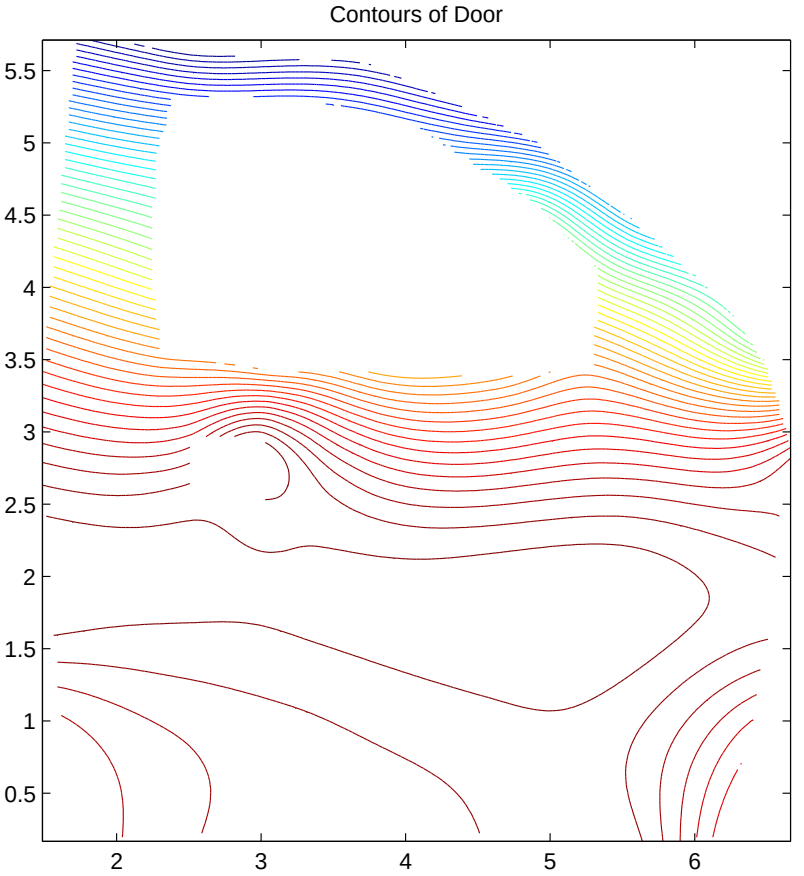
# Minimal Triharmonic Interpolatory Method



# Minimal Surface Area Method



# Conclusions

- Minimal Surface Area produces best splines and contours

# Conclusions

- Minimal Surface Area produces best splines and contours
- This is because it is a fitting method with interpolatiion at the boundary measurements;

# Conclusions

- Minimal Surface Area produces best splines and contours
- This is because it is a fitting method with interpolatiion at the boundary measurements;
- This method minimizes the surface area on the interior of the spline surface;

# Conclusions

- Minimal Surface Area produces best splines and contours
- This is because it is a fitting method with interpolatiion at the boundary measurements;
- This method minimizes the surface area on the interior of the spline surface;
- MSA spline approaches the data set on the interior, including the points among the measured data that produce the spline with MSA

# Conclusions

- Minimal Surface Area produces best splines and contours
- This is because it is a fitting method with interpolatiion at the boundary measurements;
- This method minimizes the surface area on the interior of the spline surface;
- MSA spline approaches the data set on the interior, including the points among the measured data that produce the spline with MSA
- Whereas the other methods interpolate all the measured data points, including the inherent human error.