Least-squares fitting of a local surface

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Digital Terrain Analysis
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- Since a terrain surface is very complicated and it's impossible to use any mathematical function to completely describe it, we have to interpolate.
- Use a "best" fit method on curved surfaces to avoid very high-order polynomials.
- Best fit instead of exact fit because of small variations of the surface are very complex. (stochastic process)

Least Squares

- Used to compute estimation of parameters and to fit data
- Best result is the smallest sum of square residuals (difference between modeled and predicted).

$$\sum_{i=1}^{n} e_i^2 = \min$$

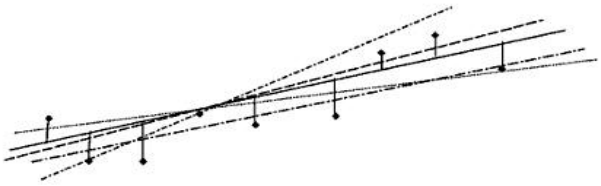


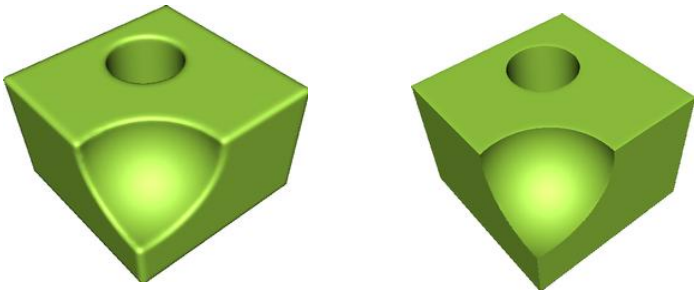
Figure 6.5 Residuals at reference points on the same type of surfaces but with different fitting.

$$Sum_{Linear} = \sum_{i=1}^{n} \Delta z_{i,L}^2$$

$$Sum_{Curved-1} = \sum_{i=1}^{n} \Delta z_{i,c-1}^2$$

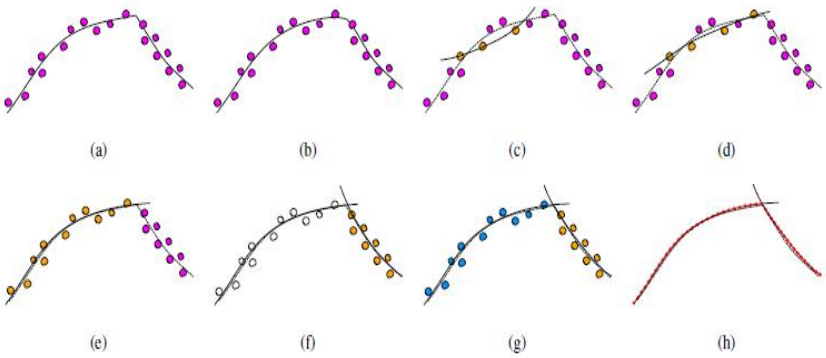
$$Sum_{Curved-1} = \sum_{i=1}^{n} \Delta z_{i,c-2}^2$$

$$z = f(x,y) = a_0 + a_1 x + a_2 y + a_3 xy + a_4 x^2 + a_5 y^2$$

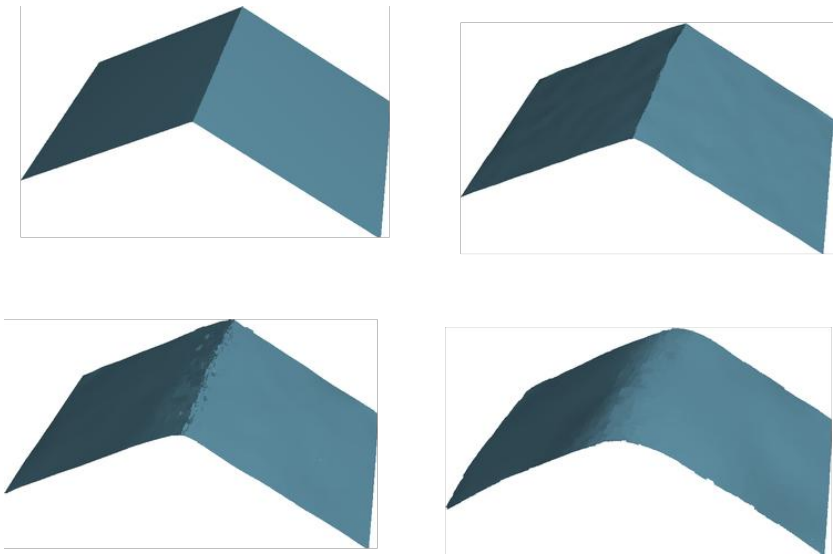


Fleishman et al. 2005

Robust Moving Least-squares



Fleishman et al. 2005



Fleishman et al. 2005

Questions?