

1. Bardsley 2.9. In exercise 1.2, you were asked to modify `Deblur1d.m` so that the convolution kernel

$$a(s) = \begin{cases} 100s + 10, & -\frac{1}{10} \leq s < 0, \\ -100s + 10, & 0 \leq s \leq \frac{1}{10}, \\ 0, & \text{otherwise} \end{cases}$$

is used instead to define \mathbf{A} .

- (a) Use Tikhonov regularization together with GCV and L-curve to reconstruct \mathbf{x} from observations \mathbf{b} . What is the optimal regularization parameter α in each case? Which gives the better reconstruction in your opinion?
- (b) Use TSVD regularization together with UPRE and DP to reconstruct \mathbf{x} from observations \mathbf{b} . What is the optimal regularization parameter k in each case? Which gives the better reconstruction in your opinion?
2. Bardsley 3.1. Modify `OnedDeblurBCs.m` so that it implements GCV and UPRE regularization parameter selection methods. How do these parameter selection methods perform in terms of the visual quality of the regularized reconstructions?

Solution:

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3. Bardsley 3.5. Use the Kronecker product properties (3.12)-(3.14) to prove (3.15) and (3.16)
4. Bardsley 3.6a. Derive the formulas for GCV analogous to (3.18). Add lines of code to `Deblur2dSeparable.m` so that it implements GCV.