Homework 3 (DRAFT)

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1 Problem 1

Exercise 2 in Section 3.6

1.1 Solution

Note: *My MATLAB code for this homework problem repeats all the steps for example 3.1 so that I can take on this problem. I will only cover the checkerboard test in this write-up.*

The checkerboard test using $\boldsymbol{m}_{true}$ can be reshaped to $\boldsymbol{m}_{true} \in \mathbb{R}^9$ such that

$$\boldsymbol{m}_{true} = \begin{bmatrix} -1 & 1 & -1 & 1 & -1 & 1 & -1 & 1 & -1 \end{bmatrix}^T$$

which allows for the creation of test data $\boldsymbol{d}_{true}$ and a recovered model $\boldsymbol{m}_{\dagger}$.

$$\boldsymbol{d}_{true} = G\boldsymbol{m}_t rue$$

$$\boldsymbol{m}_{\dagger} = G^{\dagger}\boldsymbol{d}_{true}$$

Recall from example 3.1 that $G \in \mathbb{R}^{8\times 9}$ with rank 7. Therefore the generalized pseudo-inverse of G, represented as $G^{\dagger}$, was computed using the Moore-Penrose pseudo-inverse function `pinv(G)` in MATLAB®. Figure 1 shows how the recovered model compares to the true model.

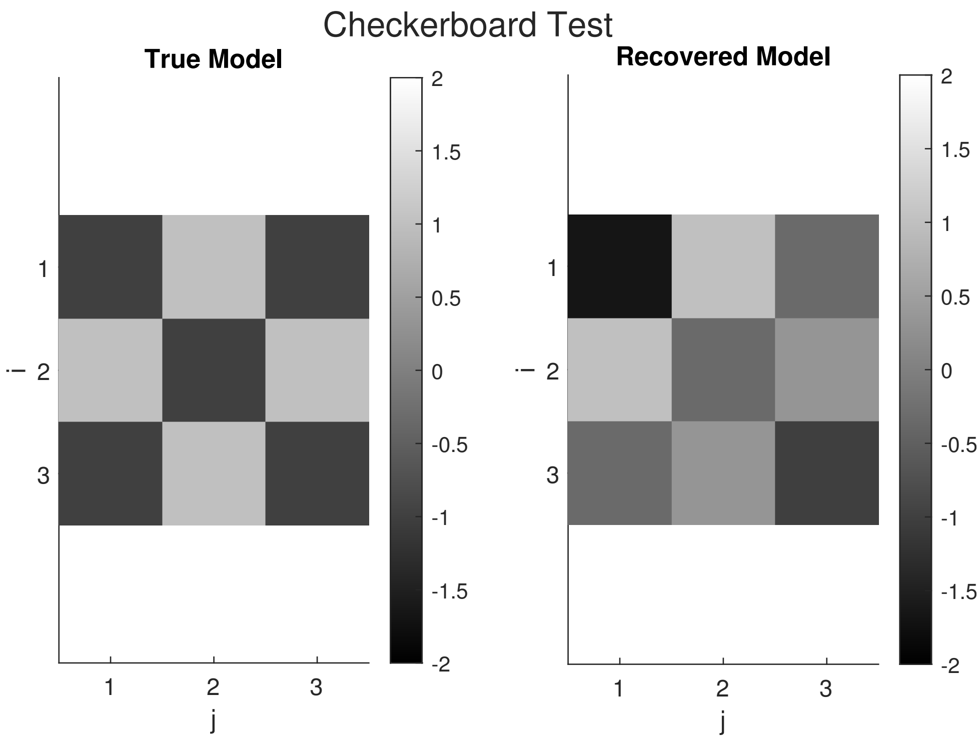

Figure 1: Checkerboard Test

Interpreting these results, only three of nine model parameters m_2, m_4, m_9 were recovered with no error. The error in the recovered model, $\boldsymbol{\Delta m} := \boldsymbol{m}_{\dagger} - \boldsymbol{m}_{true}$, is shown below.

$$\boldsymbol{\Delta m} = \begin{bmatrix} \frac{-2}{3} & 0 & \frac{2}{3} & 0 & \frac{2}{3} & \frac{-2}{3} & \frac{2}{3} & \frac{-2}{3} & 0 \end{bmatrix}^T$$