CIVE 650 - Spatiotemporal Data Analysis (2025 Fall)

Assignment 5
Spatiotemporal data analysis with dynamic mode decomposition

Date assigned: Nov. 11, 2025
Date due: Nov. 25, 2025

The `spatiotemporal_data.mat` is a 200×400 (temporal $\times$ spatial) matrix with several spatiotemporal signals, as shown in Fig. 1. Please apply dynamic mode decomposition (DMD) to analyze the data and answer the following questions:
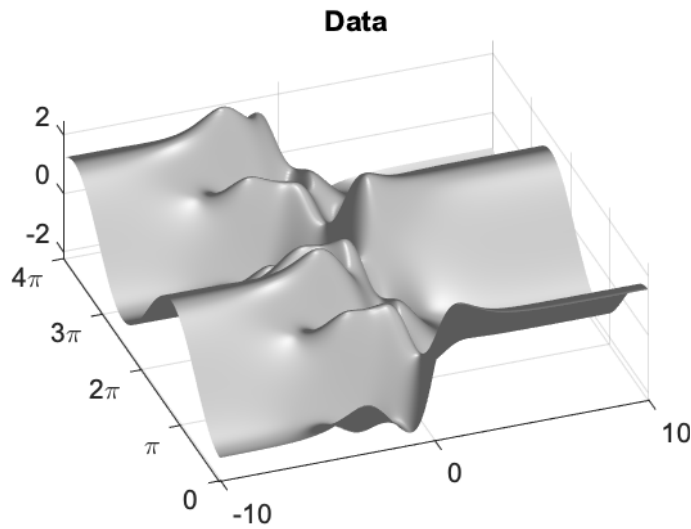

Figure 1: The mixed spatiotemporal signals (ground truth).

1. How many distinct spatiotemporal signals are present in the dataset? Please provide an explanation of the methodology used to determine this number.

2. Could you specify the frequencies associated with each individual spatiotemporal signal? Explain how you arrived at this number.

3. Could you please generate visual representations of both the spatial modes of the data and the data reconstructed using Dynamic Mode Decomposition (DMD)? Subsequently, compare the reconstructed data to the ground truth and offer insights on your observations.

4. Can you make predictions for future values within the time interval ranging from 5π to 6π, using the same sampling interval (Δt) as that of the ground truth data?