

7/28/2020

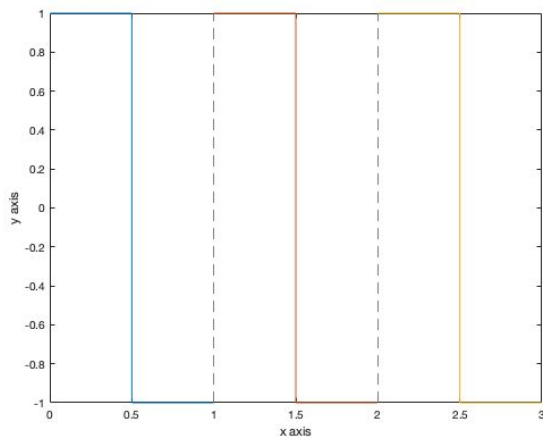
Procedure

1. Compute a R matrix, where $R_{ij} = \int \hat{\phi}_i \phi_j$. The size of this matrix is n by r , where n is the number of hat basis functions, and r is the dimension of the defined subspace
2. $V = \text{inv}(\text{lumped_m}) * R$ or $V = \text{inv}(\text{mass_matrix}) * R$
3. Apply the greedy algorithm to $V^T(OG)V$
4. We select sensor locations and can recover initial condition

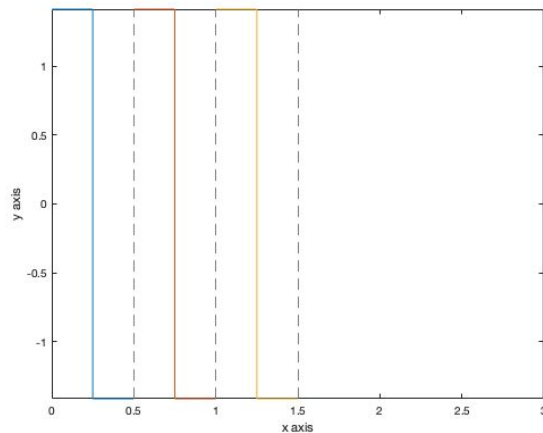
How do we compare the result

1. Form a projection matrix $P = \text{inv}(V^T V) V^T$. We use the same V matrix as before.
2. Compute $U_0_pro = P * U_0_truth$
3. Compute $U_0_pro_greedy = P * U_0_recovered_algorithm$
4. Compute $U_0_pro_random = P * U_0_recovered_random$
5. Compute the (name of the norm?) of $(U_0_pro - U_0_pro_greedy)$ and $(U_0_pro - U_0_pro_random)$ by doing

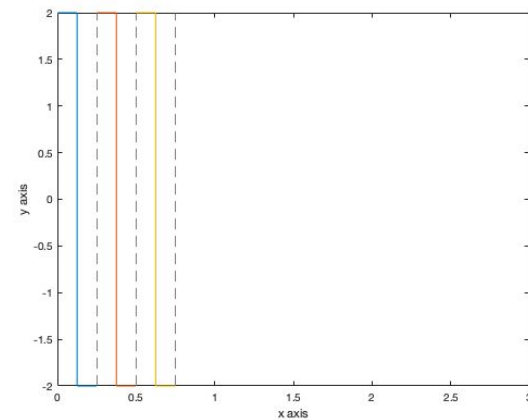
Haar Function



$J = 0, k = 0$ ←
 $J = 0, k = 1$
 $J = 0, k = 2$



$J = 1, k = 0$ ←
 $J = 1, k = 1$ ←
 $J = 1, k = 2$



$J = 2, k = 0$ ←
 $J = 2, k = 1$ ←
 $J = 2, k = 2$ ←

Use lumped mass matrix to select sensors

When forming the projection matrix, we use the lumped mass matrix

Use the actual mass matrix to measure the difference in the subspace

No Noise	10 left hat basis+sinusoidal initial condition	10 left hat basis+step initial condition	6 selected haar basis+sinusoidal initial condition	6 selected haar basis+step initial condition	5 sinusoidal basis+sinusoidal initial condition	5 sinusoidal basis+step initial condition
Select 5 sensors based on algorithm	0.1618	0.0043	25.5740	29.5071	74.8899	23.9029
Select 5 random sensors	18.3533	6.2339	53.1199	46.9357	59.3298	33.9587
Select 10 sensors based on algorithm	0.0284	0.0023	10.5275	13.2006	40.3285	16.1379
Select 10 random sensors	1.2322	2.2099	25.9963	28.0144	63.0381	21.2666

Use actual mass matrix to select sensors

When forming the projection matrix, we use the actual mass matrix

Use the actual mass matrix to measure the difference in the subspace

No Noise	10 left hat basis+sinusoidal initial condition	10 left hat basis+step initial condition	6 selected haar basis+sinusoidal initial condition	6 selected haar basis+step initial condition	5 sinusoidal basis+sinusoidal initial condition	5 sinusoidal basis+step initial condition
Select 5 sensors based on algorithm	0.1451	0.0041	21.7586	25.8639	68.3552	24.5848
Select 5 random sensors	16.7240	5.6263	45.2969	41.2549	115.7395	16.2762
Select 10 sensors based on algorithm	0.0254	0.0022	9.0444	11.6104	45.8236	14.7701
Select 10 random sensors	0.9367	2.1882	21.8545	24.8618	22.9353	7.1181