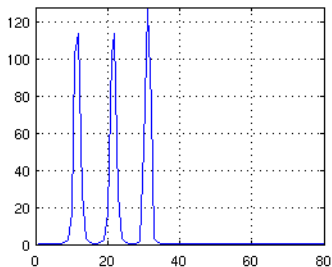
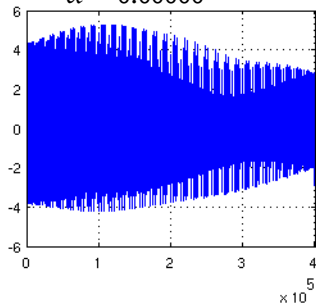


Simulation for the Preprint:  
*Signal Filtering and Persistent Homology:*  
*An Illustrative Example*

Mijail Guillemard and Armin Iske

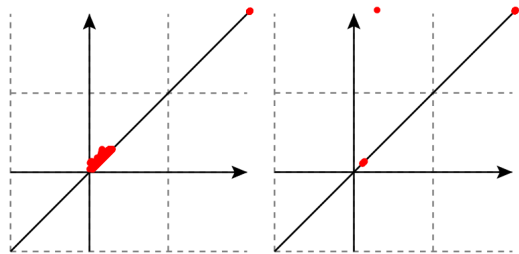
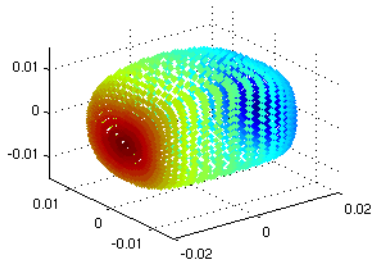
Department of Mathematics, University of Hamburg

Function  $f = (1 - \alpha)g + \alpha h$   
 $\alpha = 0.00000$



Frequency Bands

Point Cloud Data  $P(X_f)$

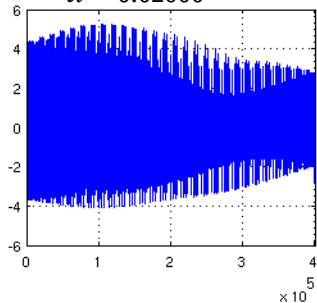


1st Homology Level

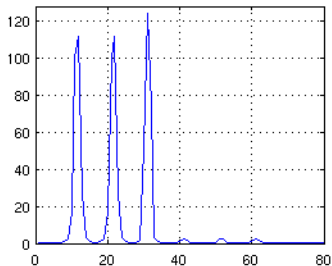
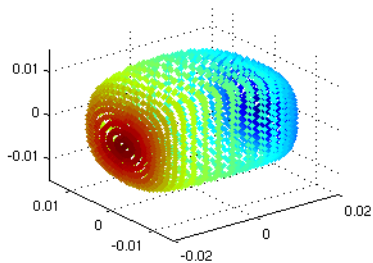
2nd Homology Level

$$Function\ f = (1 - \alpha)g + \alpha h$$

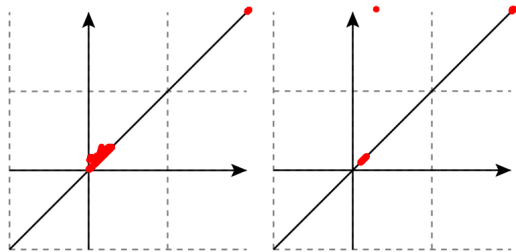
$$\alpha = 0.02000$$



Point Cloud Data  $P(X_f)$



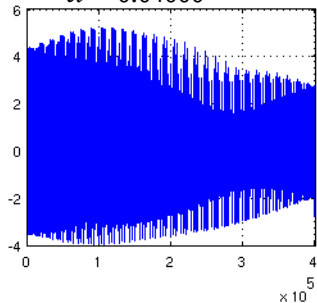
Frequency Bands



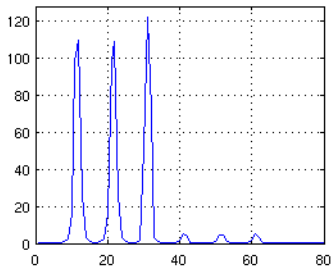
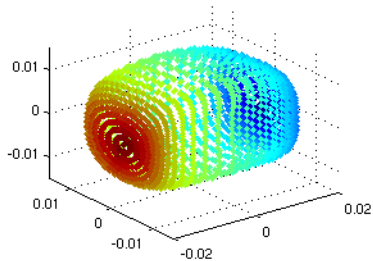
1st Homology Level

2nd Homology Level

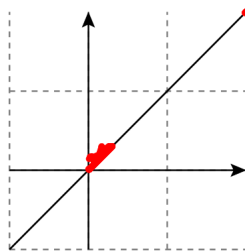
Function  $f = (1 - \alpha)g + \alpha h$   
 $\alpha = 0.04000$



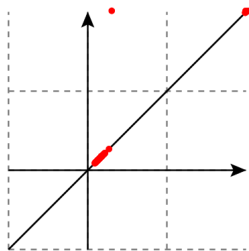
Point Cloud Data  $P(X_f)$



Frequency Bands

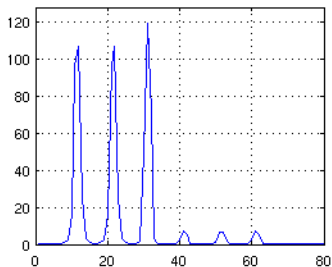
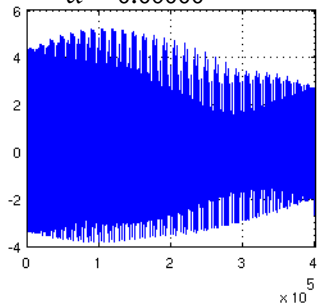


1st Homology Level



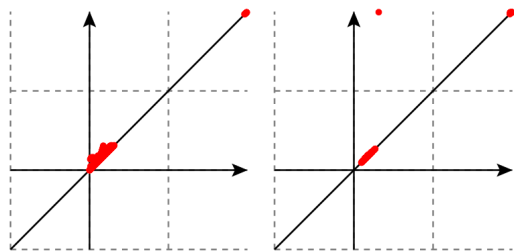
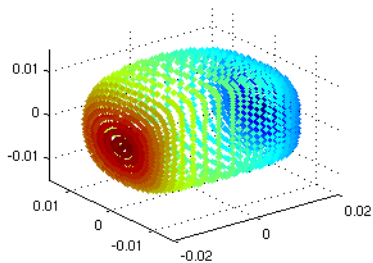
2nd Homology Level

Function  $f = (1 - \alpha)g + \alpha h$   
 $\alpha = 0.06000$



Frequency Bands

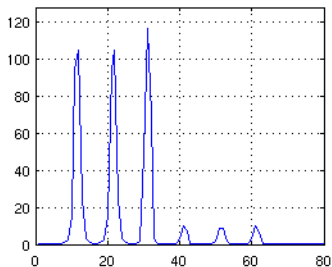
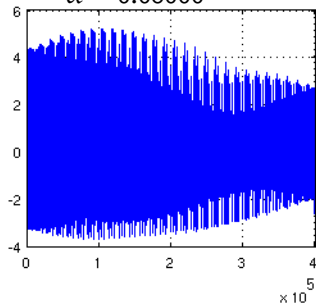
Point Cloud Data  $P(X_f)$



1st Homology Level

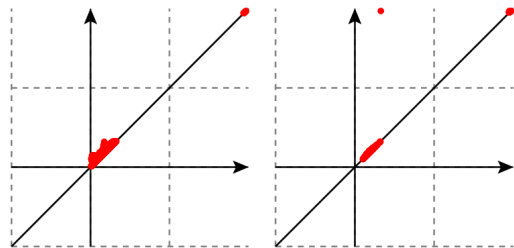
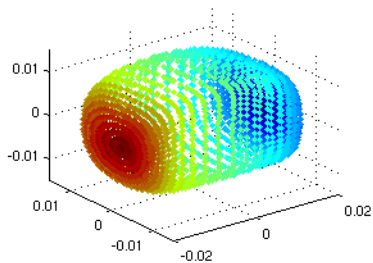
2nd Homology Level

Function  $f = (1 - \alpha)g + \alpha h$   
 $\alpha = 0.08000$



Frequency Bands

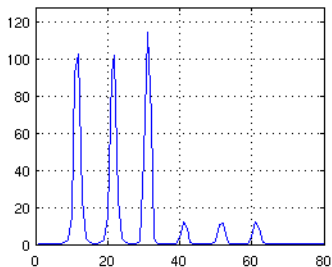
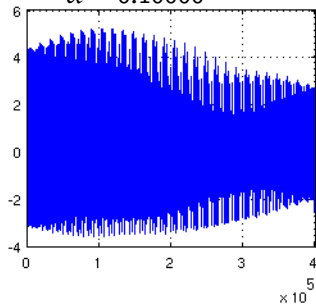
Point Cloud Data  $P(X_f)$



1st Homology Level

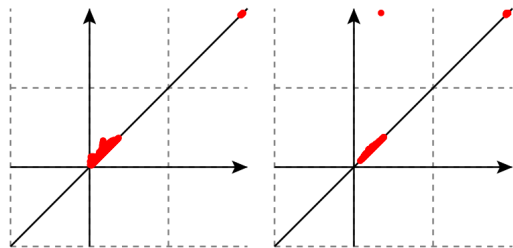
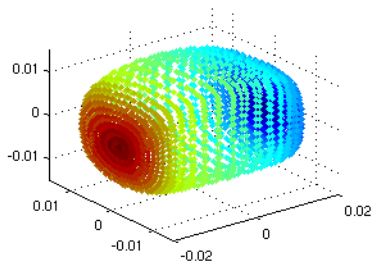
2nd Homology Level

Function  $f = (1 - \alpha)g + \alpha h$   
 $\alpha = 0.10000$



Frequency Bands

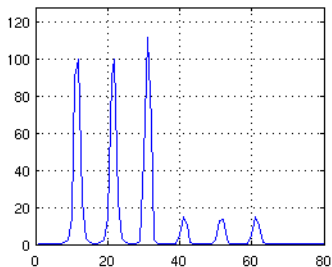
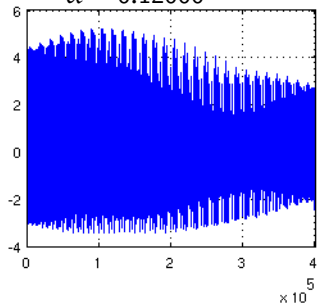
Point Cloud Data  $P(X_f)$



1st Homology Level

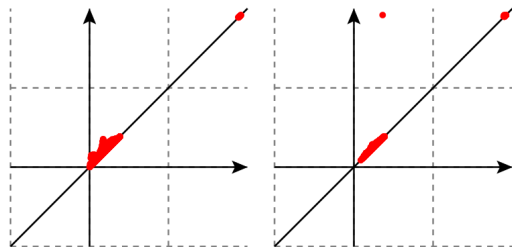
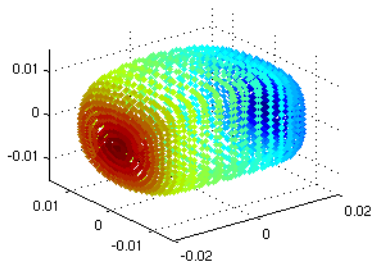
2nd Homology Level

Function  $f = (1 - \alpha)g + \alpha h$   
 $\alpha = 0.12000$



Frequency Bands

Point Cloud Data  $P(X_f)$

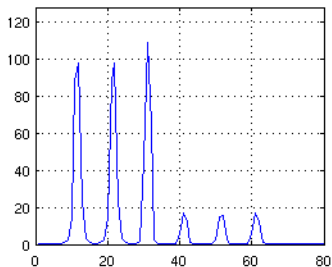
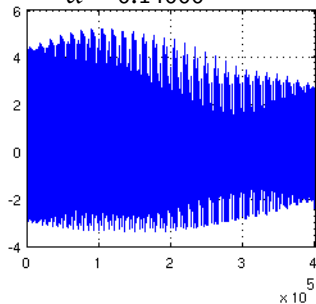


1st Homology Level

2nd Homology Level

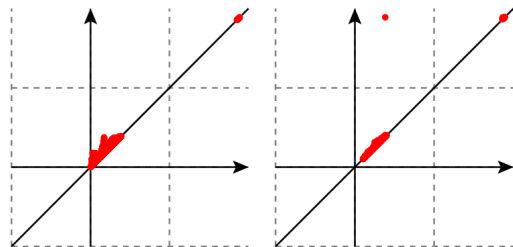
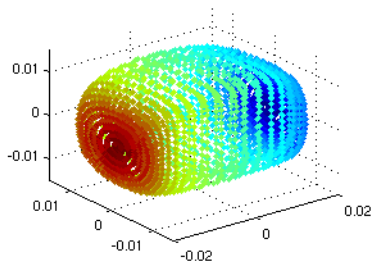


Function  $f = (1 - \alpha)g + \alpha h$   
 $\alpha = 0.14000$



Frequency Bands

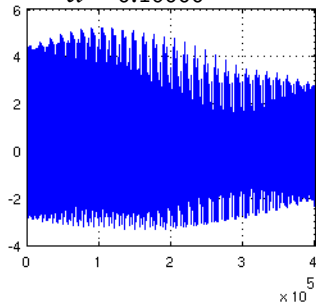
Point Cloud Data  $P(X_f)$



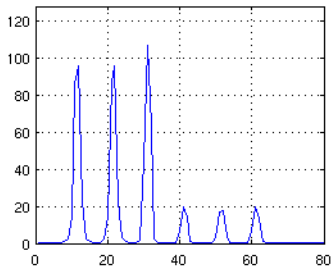
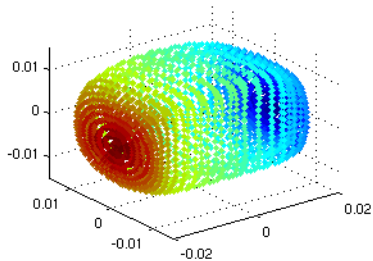
1st Homology Level

2nd Homology Level

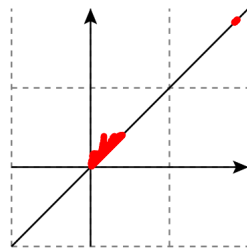
Function  $f = (1 - \alpha)g + \alpha h$   
 $\alpha = 0.16000$



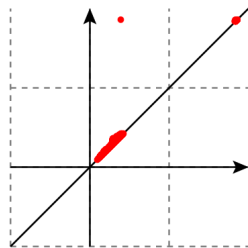
Point Cloud Data  $P(X_f)$



Frequency Bands

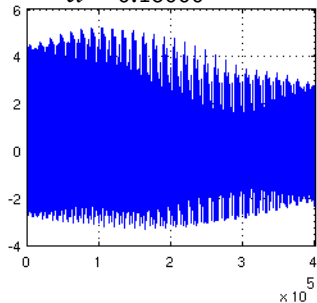


1st Homology Level

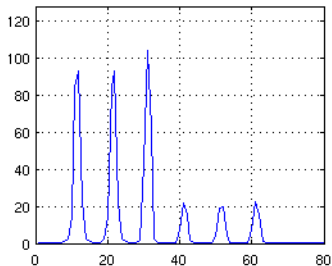
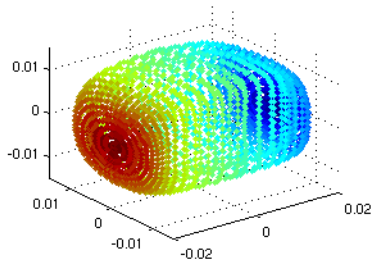


2nd Homology Level

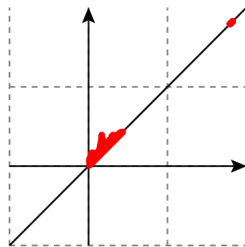
Function  $f = (1 - \alpha)g + \alpha h$   
 $\alpha = 0.18000$



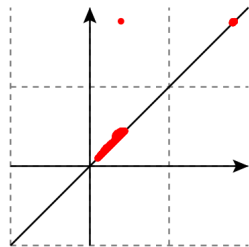
Point Cloud Data  $P(X_f)$



Frequency Bands

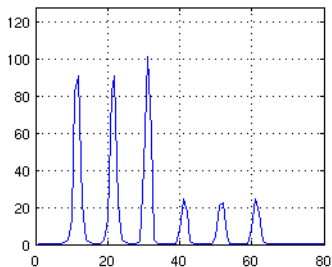
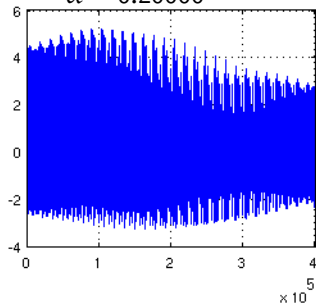


1st Homology Level



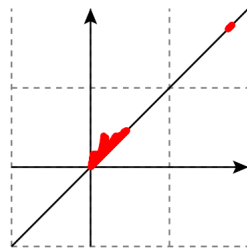
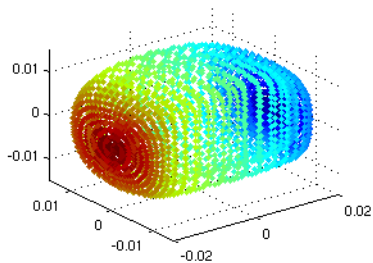
2nd Homology Level

Function  $f = (1 - \alpha)g + \alpha h$   
 $\alpha = 0.20000$

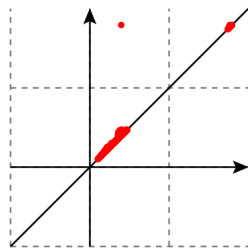


Frequency Bands

Point Cloud Data  $P(X_f)$

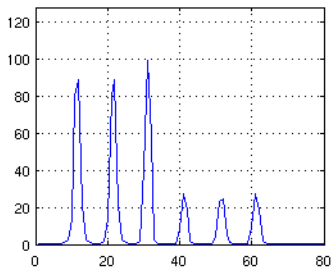
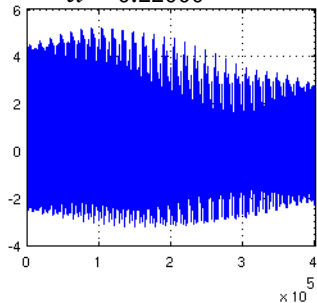


1st Homology Level



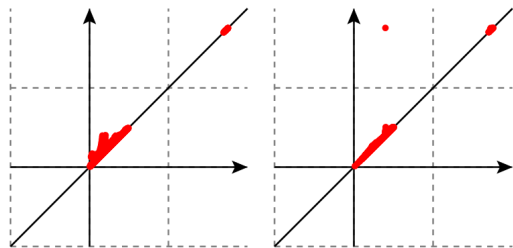
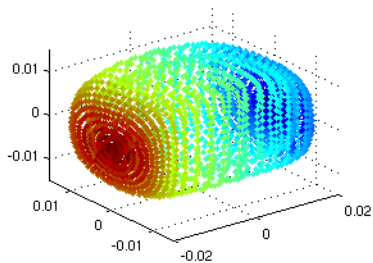
2nd Homology Level

Function  $f = (1 - \alpha)g + \alpha h$   
 $\alpha = 0.22000$



Frequency Bands

Point Cloud Data  $P(X_f)$

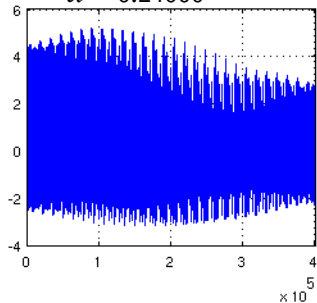


1st Homology Level

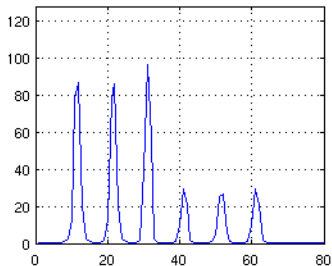
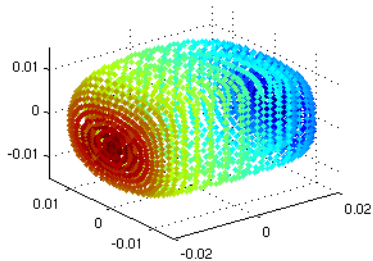
2nd Homology Level

$$Function f = (1 - \alpha)g + \alpha h$$

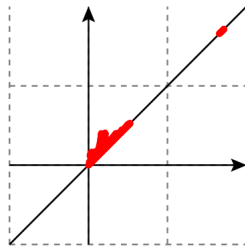
$$\alpha = 0.24000$$



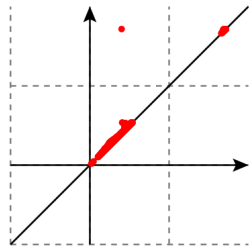
Point Cloud Data  $P(X_f)$



Frequency Bands



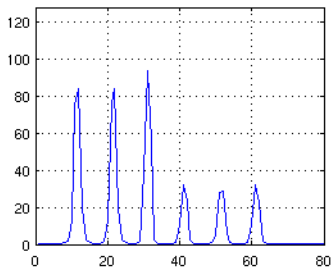
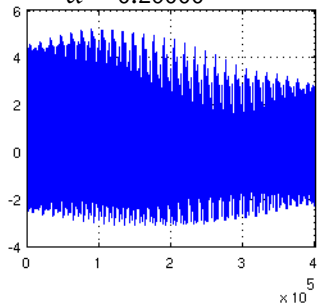
1st Homology Level



2nd Homology Level

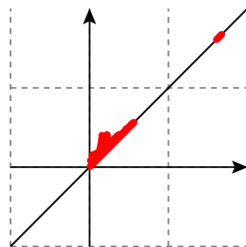
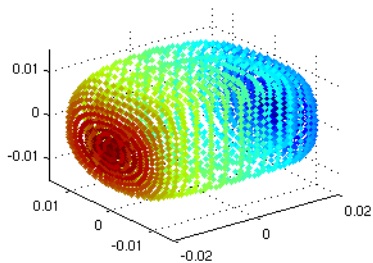
$$Function f = (1 - \alpha)g + \alpha h$$

$$\alpha = 0.26000$$

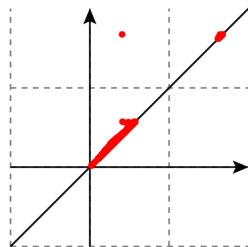


Frequency Bands

Point Cloud Data  $P(X_f)$



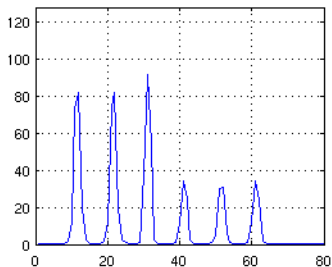
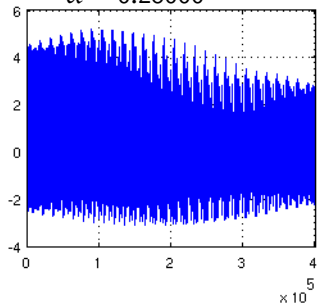
1st Homology Level



2nd Homology Level

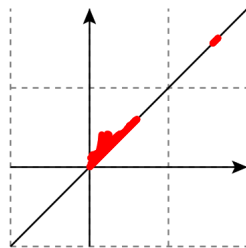
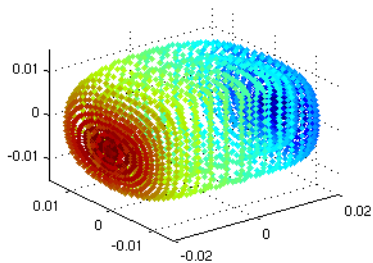
$$Function f = (1 - \alpha)g + \alpha h$$

$$\alpha = 0.28000$$

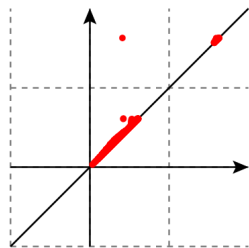


Frequency Bands

Point Cloud Data  $P(X_f)$



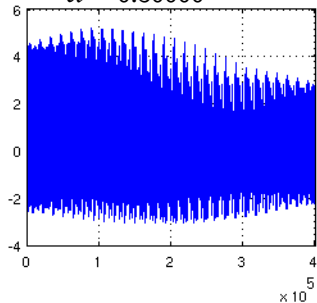
1st Homology Level



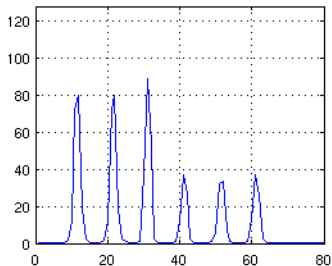
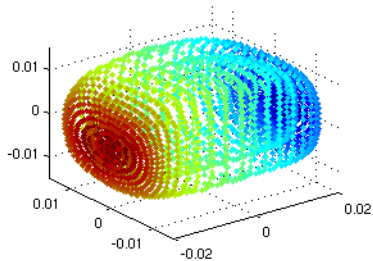
2nd Homology Level



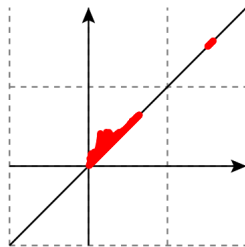
Function  $f = (1 - \alpha)g + \alpha h$   
 $\alpha = 0.30000$



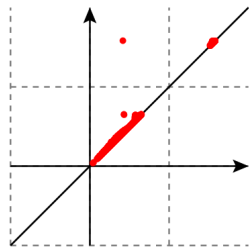
Point Cloud Data  $P(X_f)$



Frequency Bands

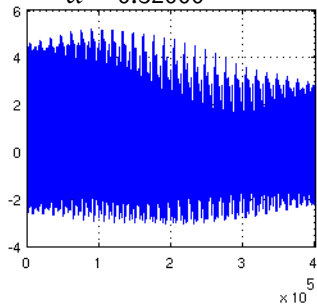


1st Homology Level

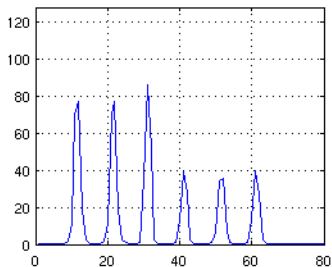
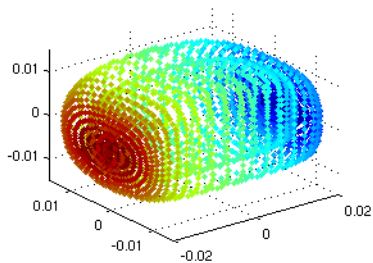


2nd Homology Level

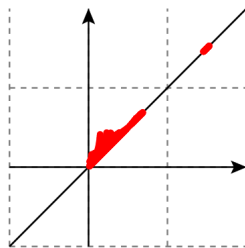
Function  $f = (1 - \alpha)g + \alpha h$   
 $\alpha = 0.32000$



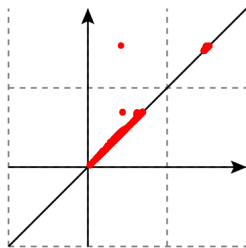
Point Cloud Data  $P(X_f)$



Frequency Bands



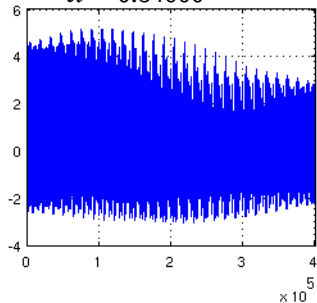
1st Homology Level



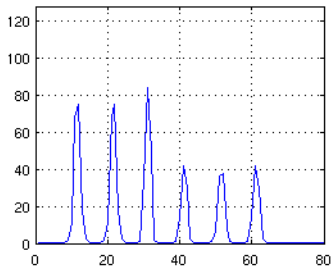
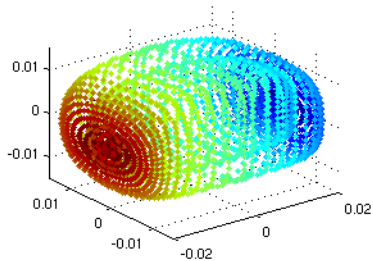
2nd Homology Level

$$Function f = (1 - \alpha)g + \alpha h$$

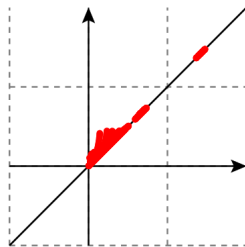
$$\alpha = 0.34000$$



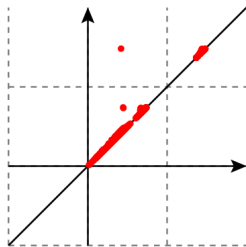
Point Cloud Data  $P(X_f)$



Frequency Bands

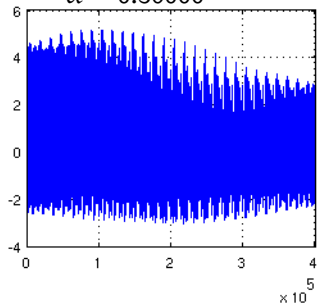


1st Homology Level

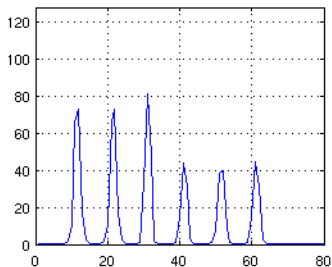
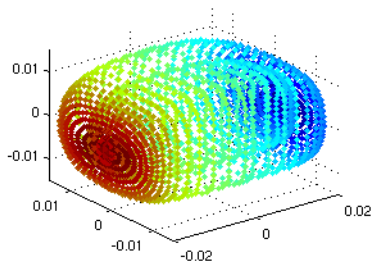


2nd Homology Level

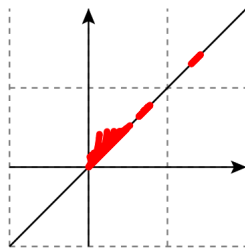
Function  $f = (1 - \alpha)g + \alpha h$   
 $\alpha = 0.36000$



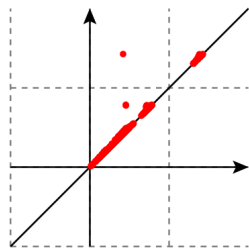
Point Cloud Data  $P(X_f)$



Frequency Bands

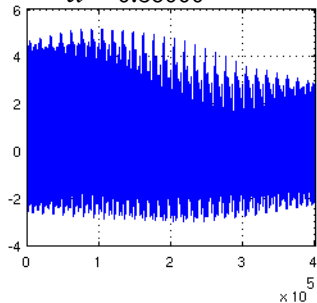


1st Homology Level

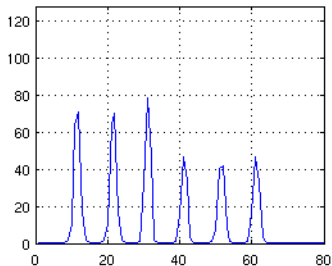
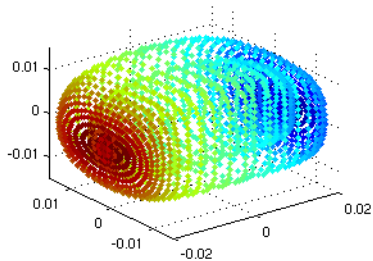


2nd Homology Level

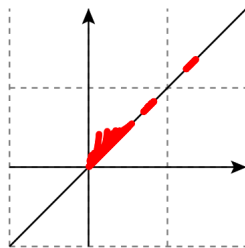
Function  $f = (1 - \alpha)g + \alpha h$   
 $\alpha = 0.38000$



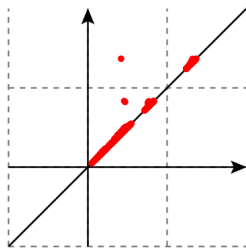
Point Cloud Data  $P(X_f)$



Frequency Bands

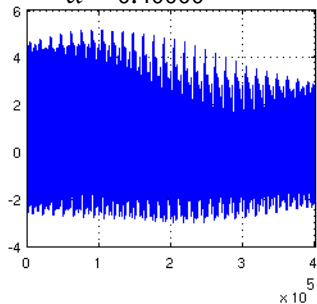


1st Homology Level

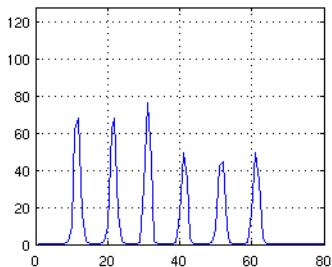
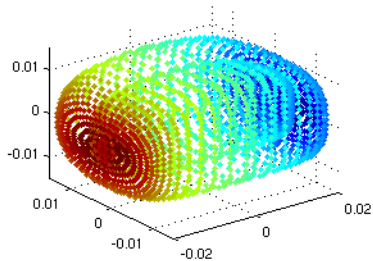


2nd Homology Level

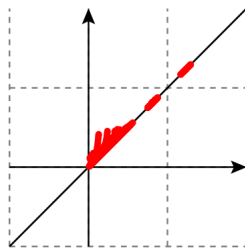
Function  $f = (1 - \alpha)g + \alpha h$   
 $\alpha = 0.40000$



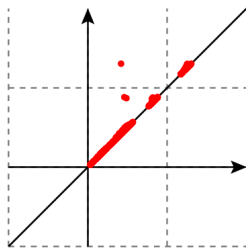
Point Cloud Data  $P(X_f)$



Frequency Bands

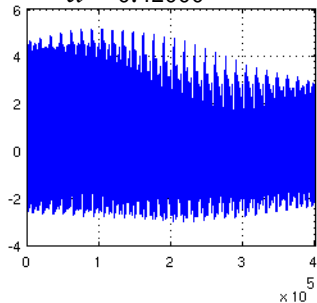


1st Homology Level

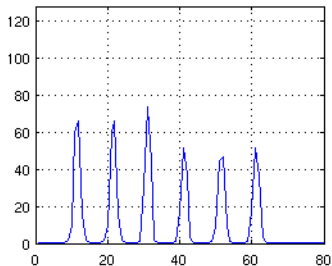
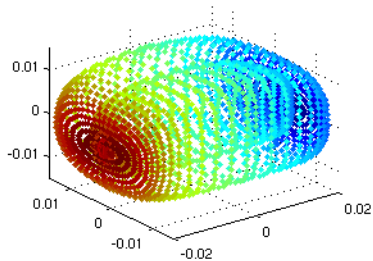


2nd Homology Level

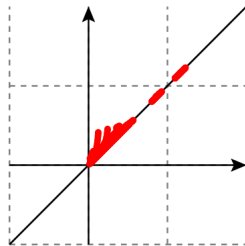
$$\text{Function } f = (1 - \alpha)g + \alpha h$$
$$\alpha = 0.42000$$



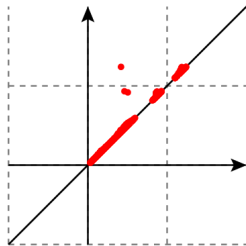
Point Cloud Data  $P(X_f)$



Frequency Bands

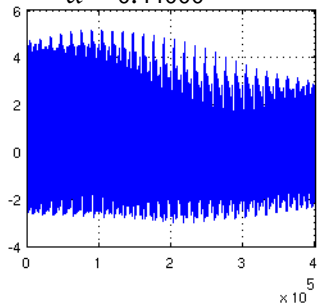


1st Homology Level

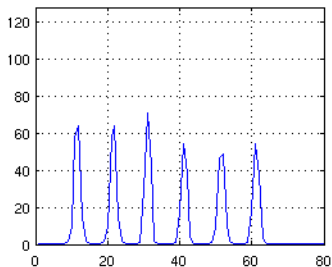
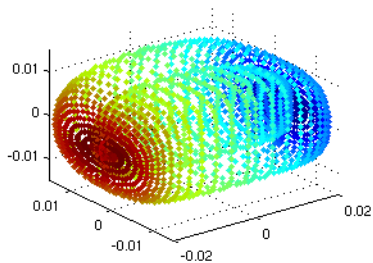


2nd Homology Level

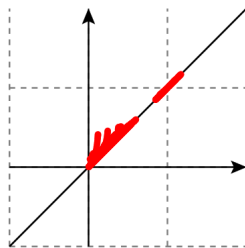
$$Function f = (1 - \alpha)g + \alpha h$$
$$\alpha = 0.44000$$



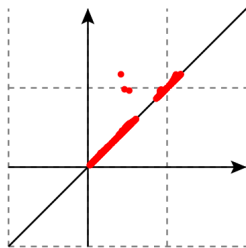
Point Cloud Data  $P(X_f)$



Frequency Bands



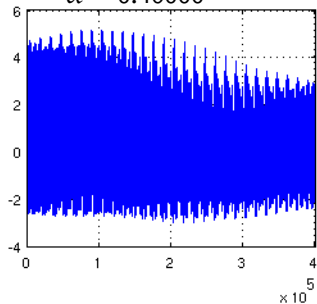
1st Homology Level



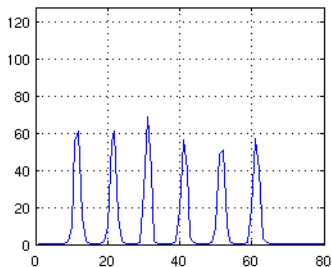
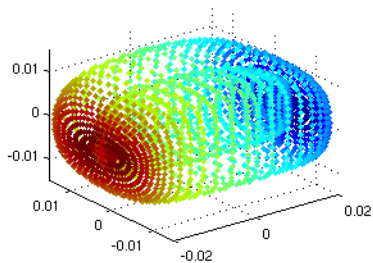
2nd Homology Level



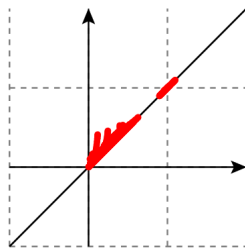
Function  $f = (1 - \alpha)g + \alpha h$   
 $\alpha = 0.46000$



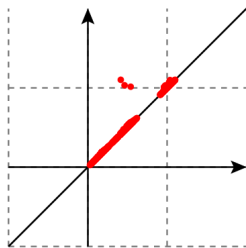
Point Cloud Data  $P(X_f)$



Frequency Bands

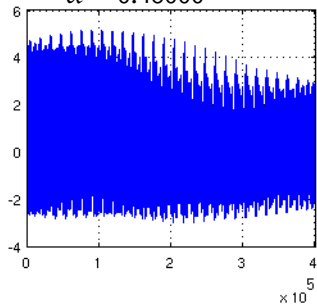


1st Homology Level

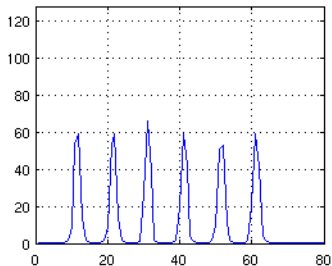
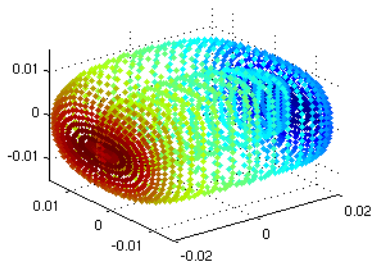


2nd Homology Level

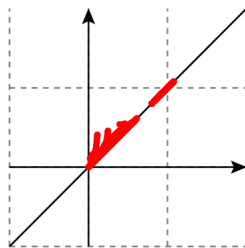
Function  $f = (1 - \alpha)g + \alpha h$   
 $\alpha = 0.48000$



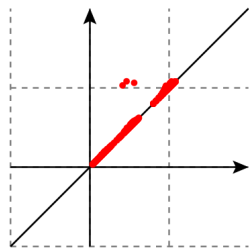
Point Cloud Data  $P(X_f)$



Frequency Bands

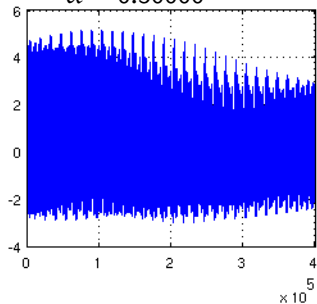


1st Homology Level

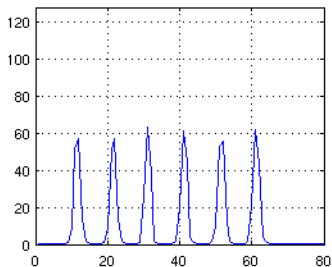
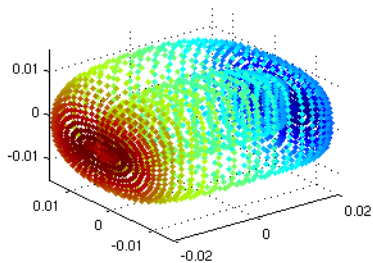


2nd Homology Level

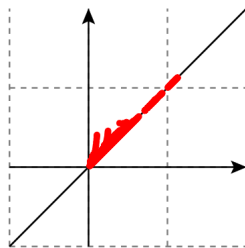
Function  $f = (1 - \alpha)g + \alpha h$   
 $\alpha = 0.50000$



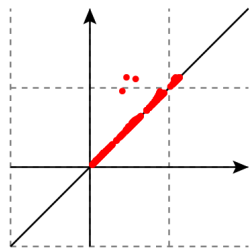
Point Cloud Data  $P(X_f)$



Frequency Bands

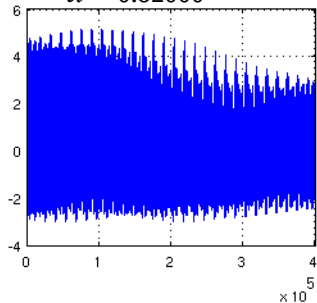


1st Homology Level

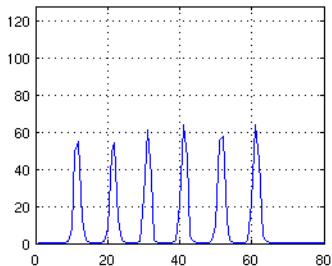
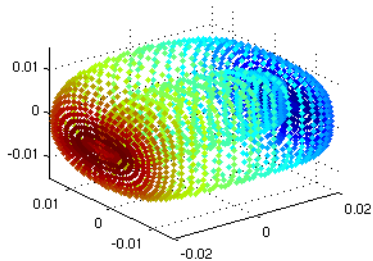


2nd Homology Level

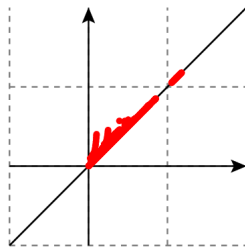
$$\text{Function } f = (1 - \alpha)g + \alpha h$$
$$\alpha = 0.52000$$



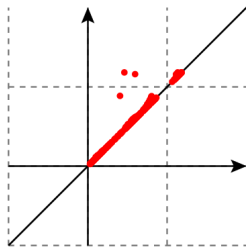
Point Cloud Data  $P(X_f)$



Frequency Bands

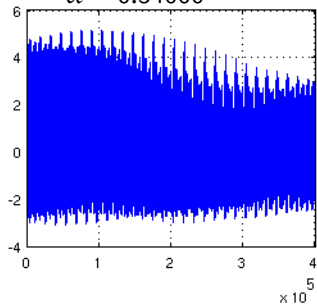


1st Homology Level

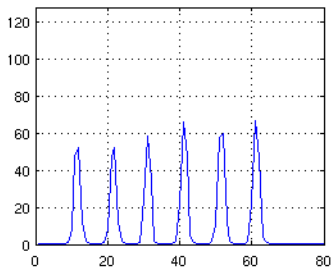
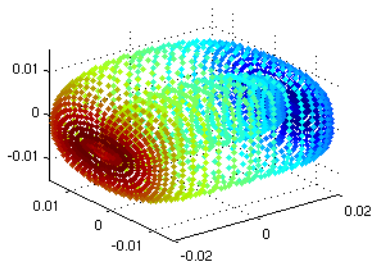


2nd Homology Level

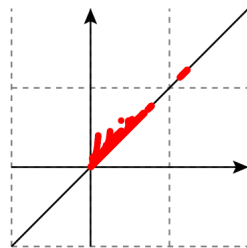
$$\text{Function } f = (1 - \alpha)g + \alpha h$$
$$\alpha = 0.54000$$



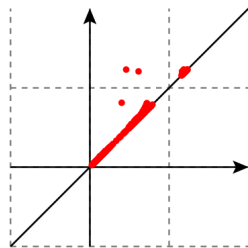
Point Cloud Data  $P(X_f)$



Frequency Bands

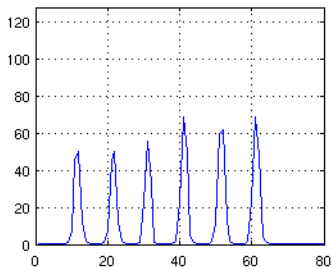
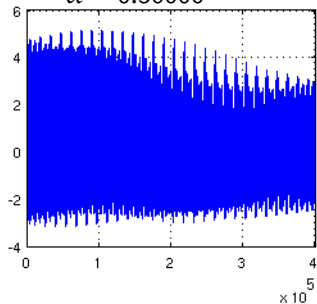


1st Homology Level



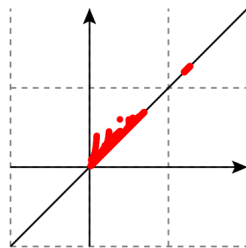
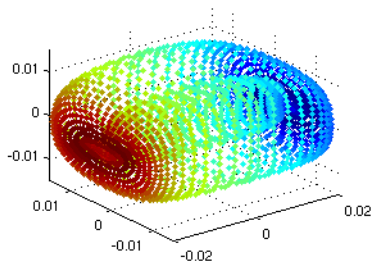
2nd Homology Level

Function  $f = (1 - \alpha)g + \alpha h$   
 $\alpha = 0.56000$

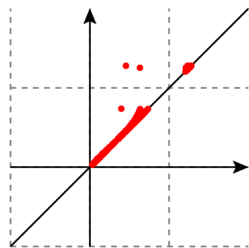


Frequency Bands

Point Cloud Data  $P(X_f)$

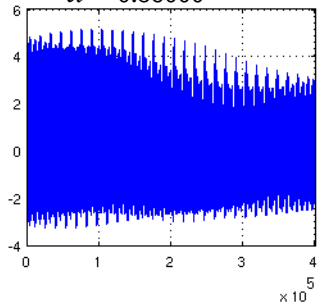


1st Homology Level

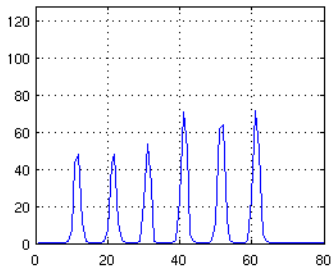
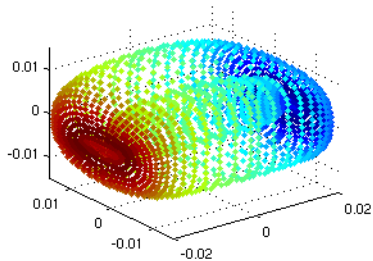


2nd Homology Level

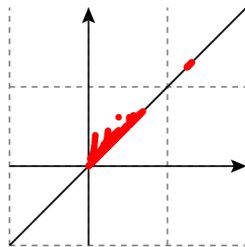
Function  $f = (1 - \alpha)g + \alpha h$   
 $\alpha = 0.58000$



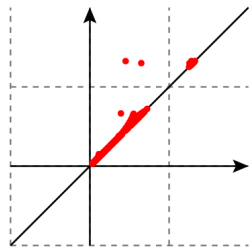
Point Cloud Data  $P(X_f)$



Frequency Bands

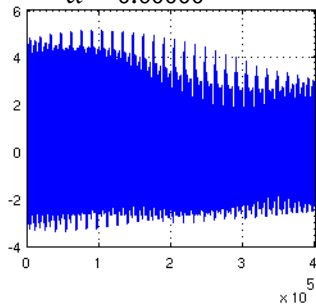


1st Homology Level

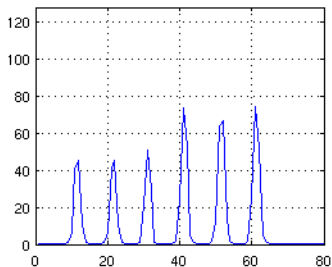
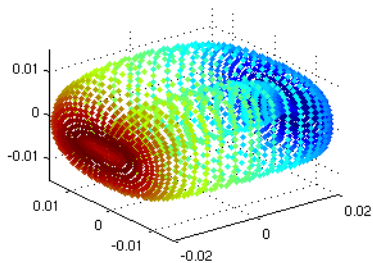


2nd Homology Level

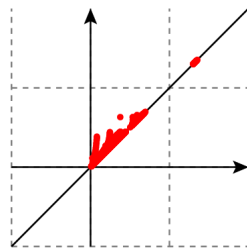
Function  $f = (1 - \alpha)g + \alpha h$   
 $\alpha = 0.60000$



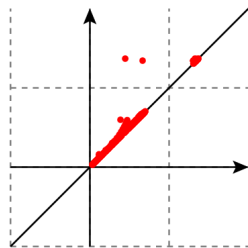
Point Cloud Data  $P(X_f)$



Frequency Bands



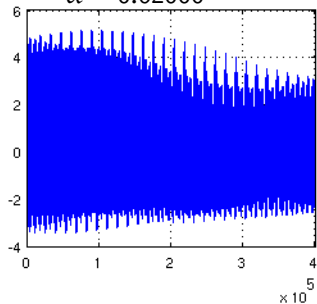
1st Homology Level



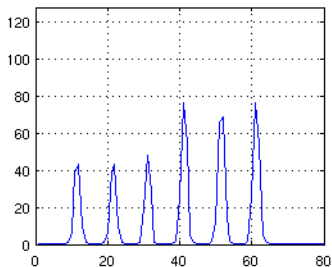
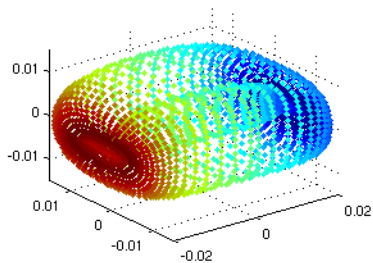
2nd Homology Level



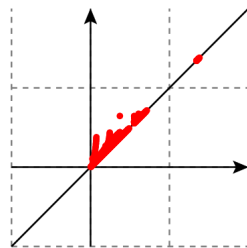
Function  $f = (1 - \alpha)g + \alpha h$   
 $\alpha = 0.62000$



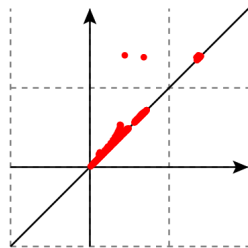
Point Cloud Data  $P(X_f)$



Frequency Bands

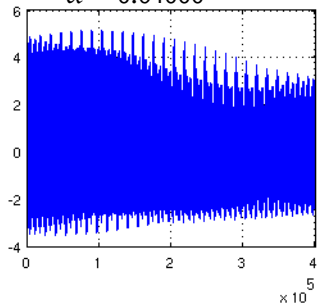


1st Homology Level

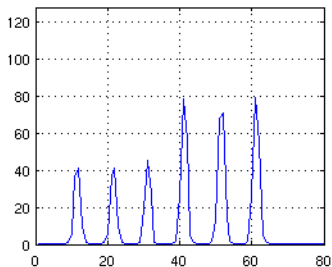
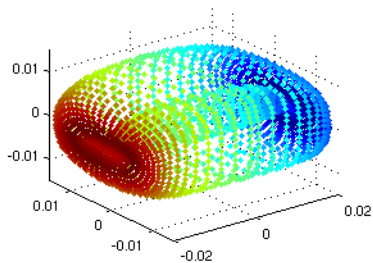


2nd Homology Level

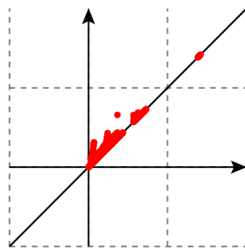
Function  $f = (1 - \alpha)g + \alpha h$   
 $\alpha = 0.64000$



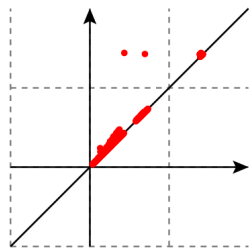
Point Cloud Data  $P(X_f)$



Frequency Bands

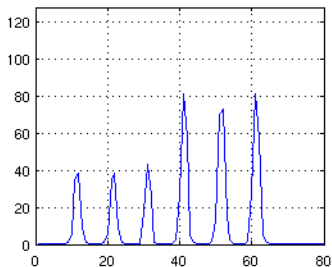
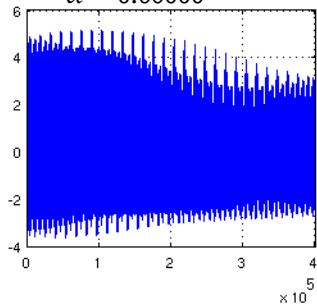


1st Homology Level



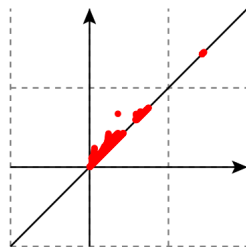
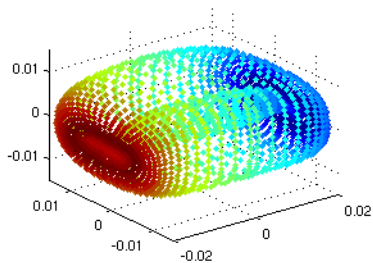
2nd Homology Level

$$\text{Function } f = (1 - \alpha)g + \alpha h$$
$$\alpha = 0.66000$$

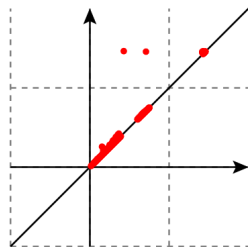


Frequency Bands

Point Cloud Data  $P(X_f)$

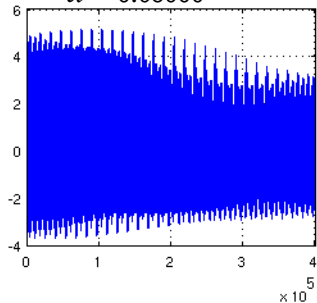


1st Homology Level

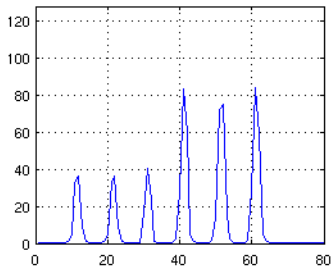
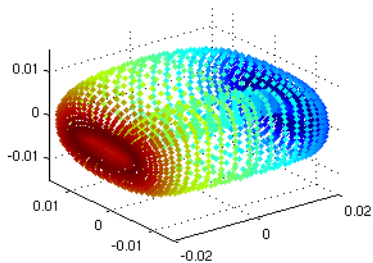


2nd Homology Level

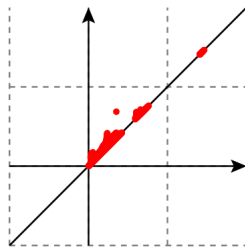
Function  $f = (1 - \alpha)g + \alpha h$   
 $\alpha = 0.68000$



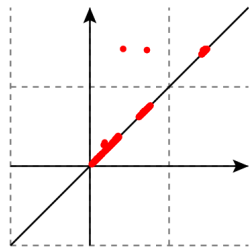
Point Cloud Data  $P(X_f)$



Frequency Bands

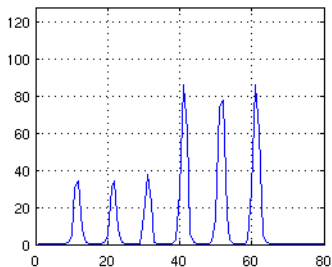
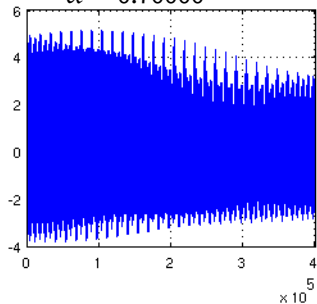


1st Homology Level



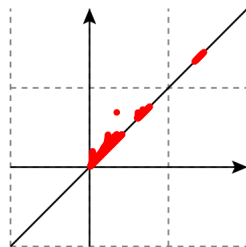
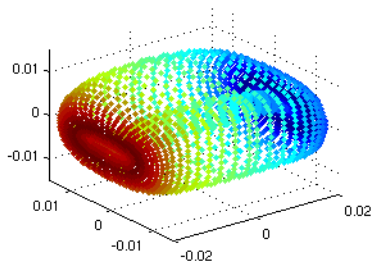
2nd Homology Level

$$\text{Function } f = (1 - \alpha)g + \alpha h$$
$$\alpha = 0.70000$$

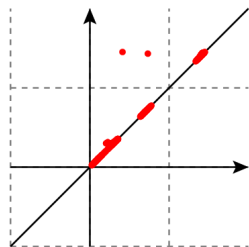


Frequency Bands

Point Cloud Data  $P(X_f)$



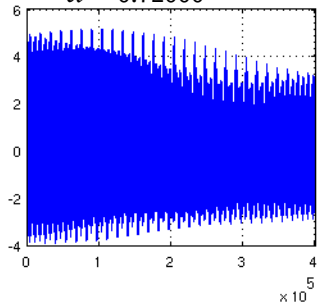
1st Homology Level



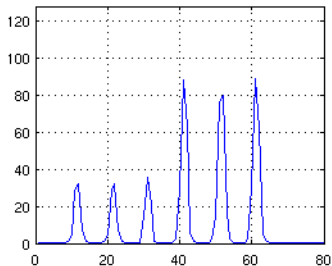
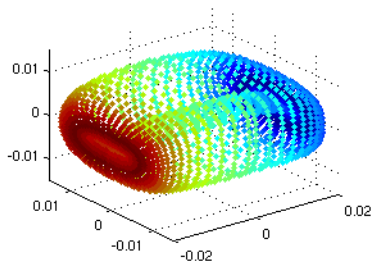
2nd Homology Level

$$Function f = (1 - \alpha)g + \alpha h$$

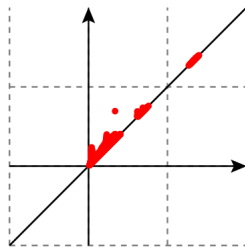
$$\alpha = 0.72000$$



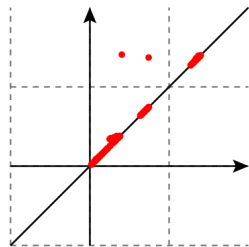
Point Cloud Data  $P(X_f)$



Frequency Bands



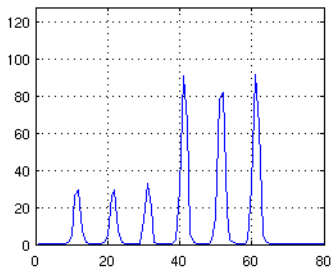
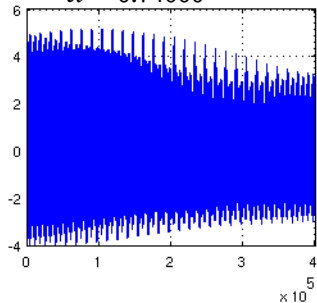
1st Homology Level



2nd Homology Level

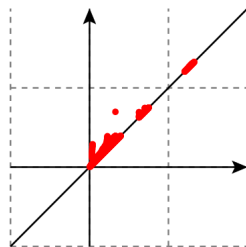
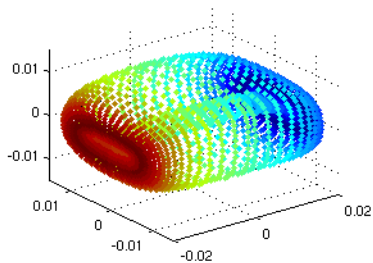
$$Function f = (1 - \alpha)g + \alpha h$$

$$\alpha = 0.74000$$

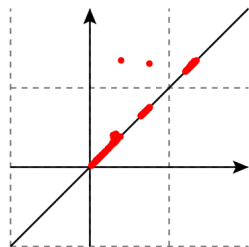


Frequency Bands

Point Cloud Data  $P(X_f)$



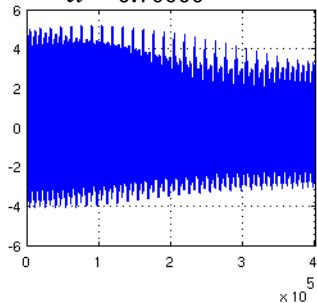
1st Homology Level



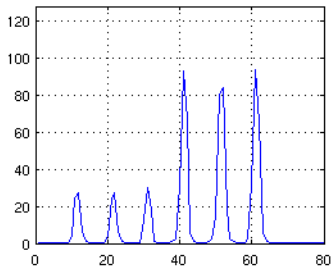
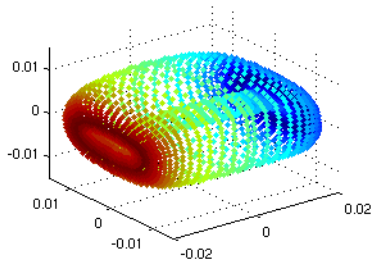
2nd Homology Level

$$Function f = (1 - \alpha)g + \alpha h$$

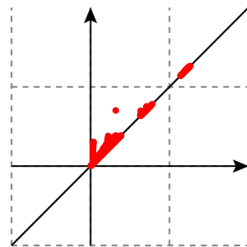
$$\alpha = 0.76000$$



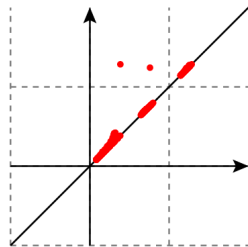
Point Cloud Data  $P(X_f)$



Frequency Bands



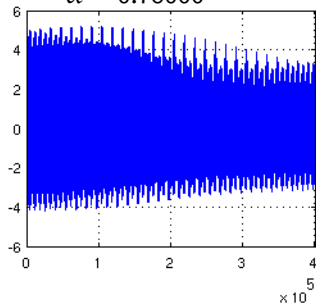
1st Homology Level



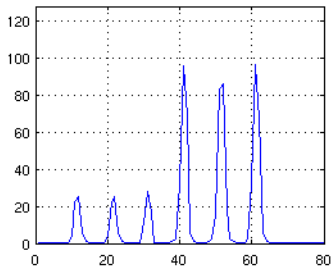
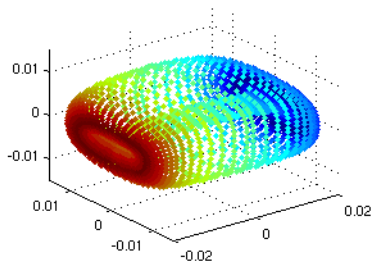
2nd Homology Level



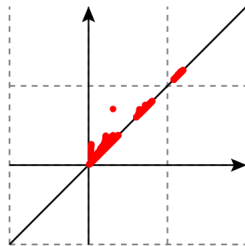
$$f = (1 - \alpha)g + \alpha h$$
$$\alpha = 0.78000$$



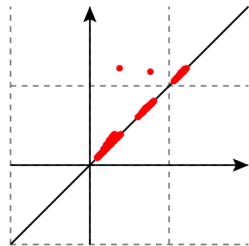
Point Cloud Data  $P(X_f)$



Frequency Bands

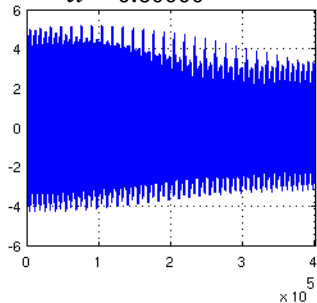


1st Homology Level

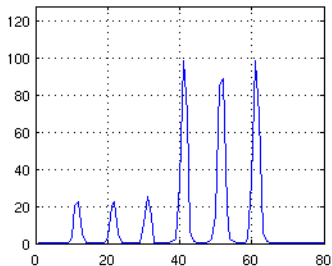
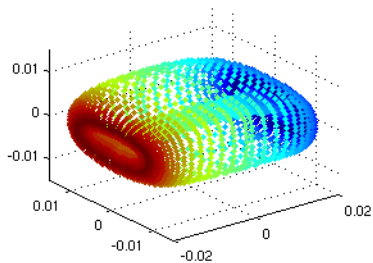


2nd Homology Level

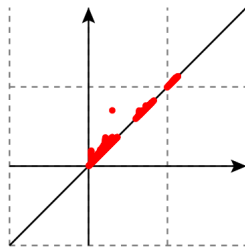
$$\text{Function } f = (1 - \alpha)g + \alpha h$$
$$\alpha = 0.80000$$



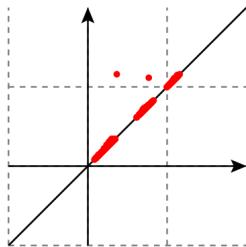
Point Cloud Data  $P(X_f)$



Frequency Bands

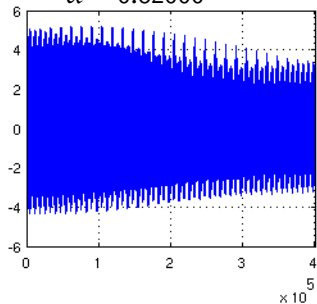


1st Homology Level

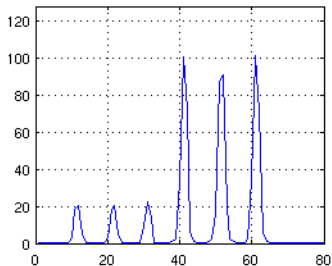
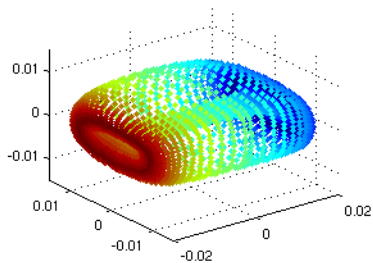


2nd Homology Level

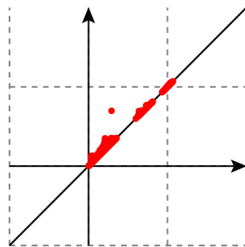
Function  $f = (1 - \alpha)g + \alpha h$   
 $\alpha = 0.82000$



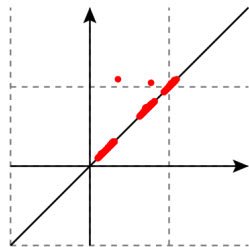
Point Cloud Data  $P(X_f)$



Frequency Bands

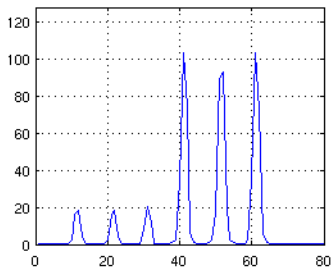
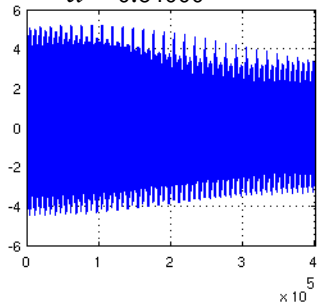


1st Homology Level



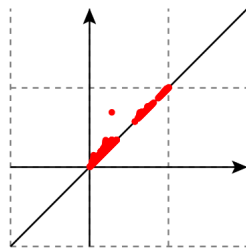
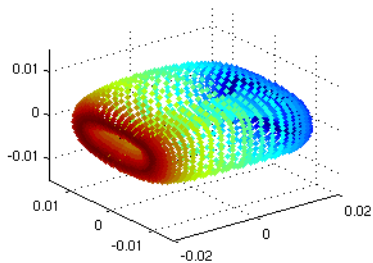
2nd Homology Level

Function  $f = (1 - \alpha)g + \alpha h$   
 $\alpha = 0.84000$

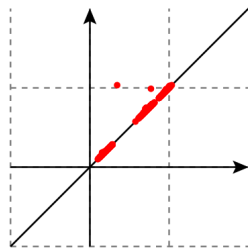


Frequency Bands

Point Cloud Data  $P(X_f)$

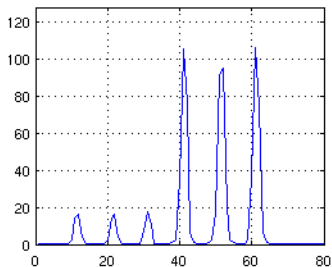
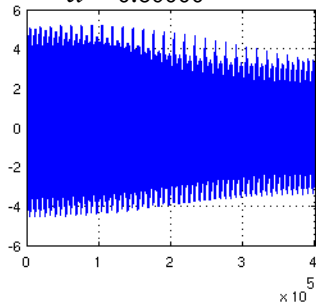


1st Homology Level



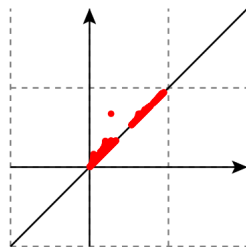
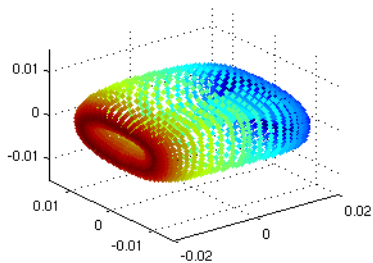
2nd Homology Level

$$Function f = (1 - \alpha)g + \alpha h$$
$$\alpha = 0.86000$$

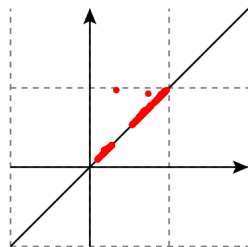


Frequency Bands

Point Cloud Data  $P(X_f)$

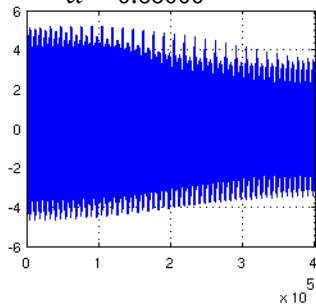


1st Homology Level

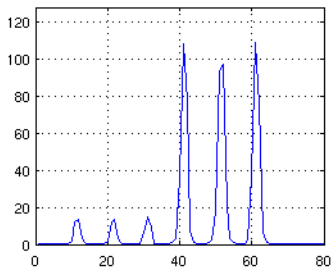
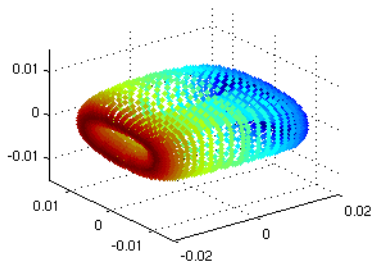


2nd Homology Level

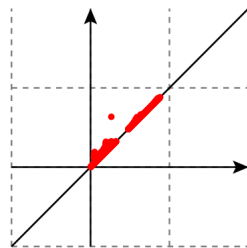
Function  $f = (1 - \alpha)g + \alpha h$   
 $\alpha = 0.88000$



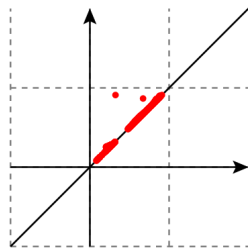
Point Cloud Data  $P(X_f)$



Frequency Bands

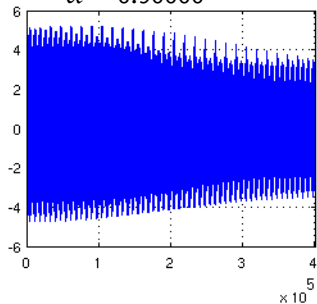


1st Homology Level

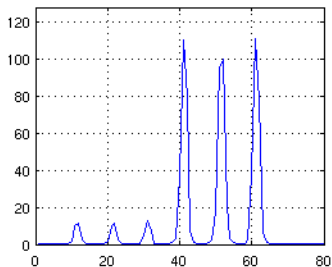
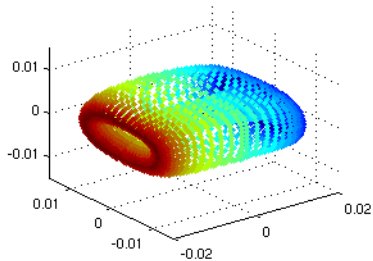


2nd Homology Level

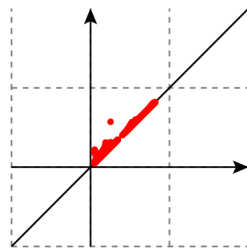
Function  $f = (1 - \alpha)g + \alpha h$   
 $\alpha = 0.90000$



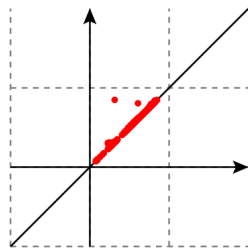
Point Cloud Data  $P(X_f)$



Frequency Bands

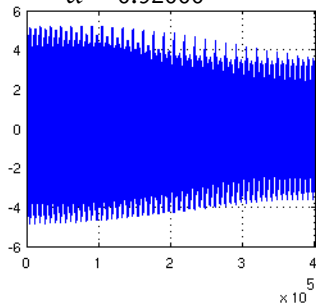


1st Homology Level

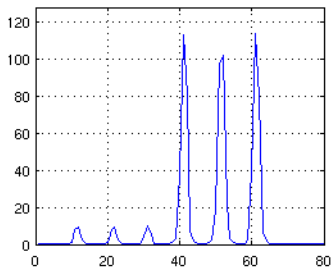
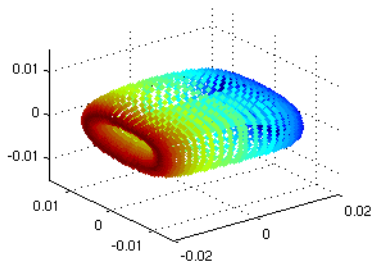


2nd Homology Level

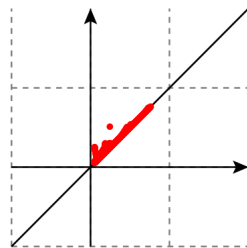
$$\text{Function } f = (1 - \alpha)g + \alpha h$$
$$\alpha = 0.92000$$



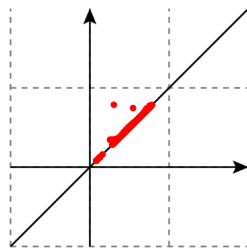
Point Cloud Data  $P(X_f)$



Frequency Bands



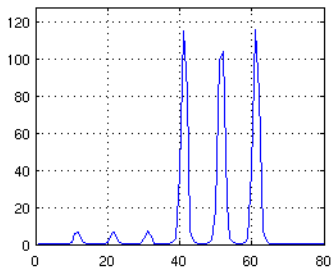
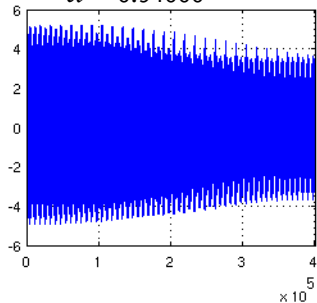
1st Homology Level



2nd Homology Level

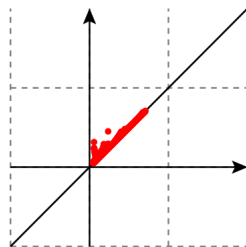
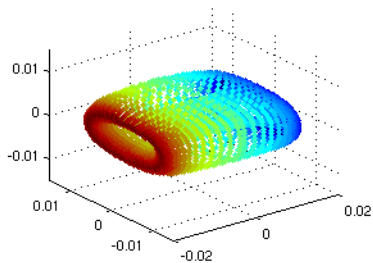


$$\text{Function } f = (1 - \alpha)g + \alpha h$$
$$\alpha = 0.94000$$

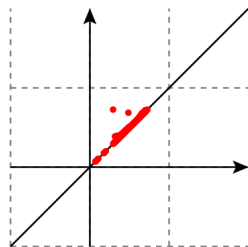


Frequency Bands

Point Cloud Data  $P(X_f)$



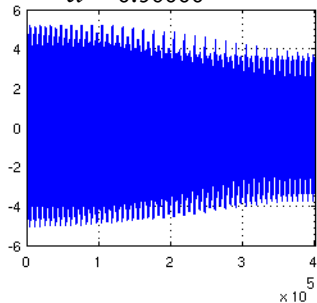
1st Homology Level



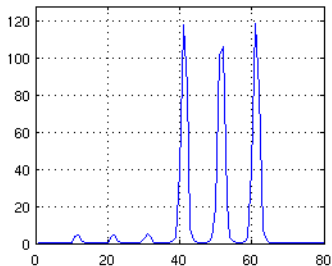
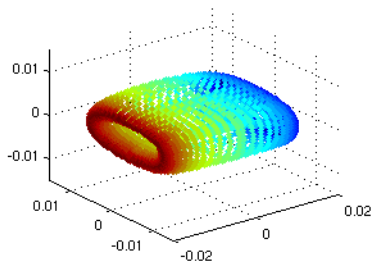
2nd Homology Level

$$f = (1 - \alpha)g + \alpha h$$

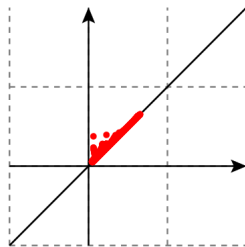
$$\alpha = 0.96000$$



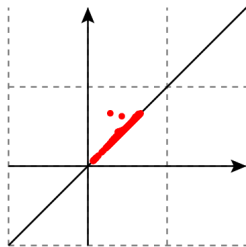
Point Cloud Data  $P(X_f)$



Frequency Bands

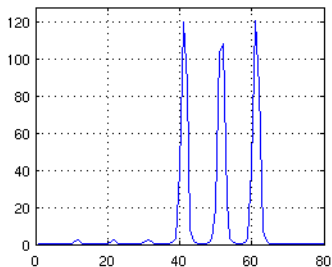
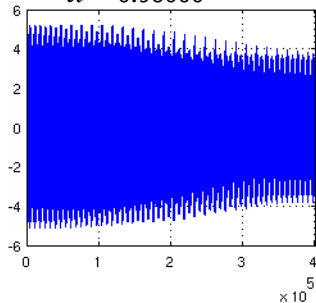


1st Homology Level



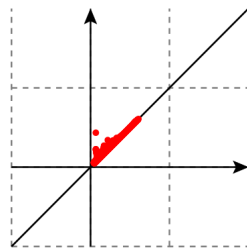
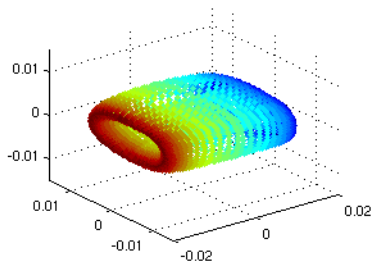
2nd Homology Level

Function  $f = (1 - \alpha)g + \alpha h$   
 $\alpha = 0.98000$

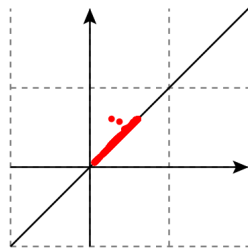


Frequency Bands

Point Cloud Data  $P(X_f)$



1st Homology Level



2nd Homology Level