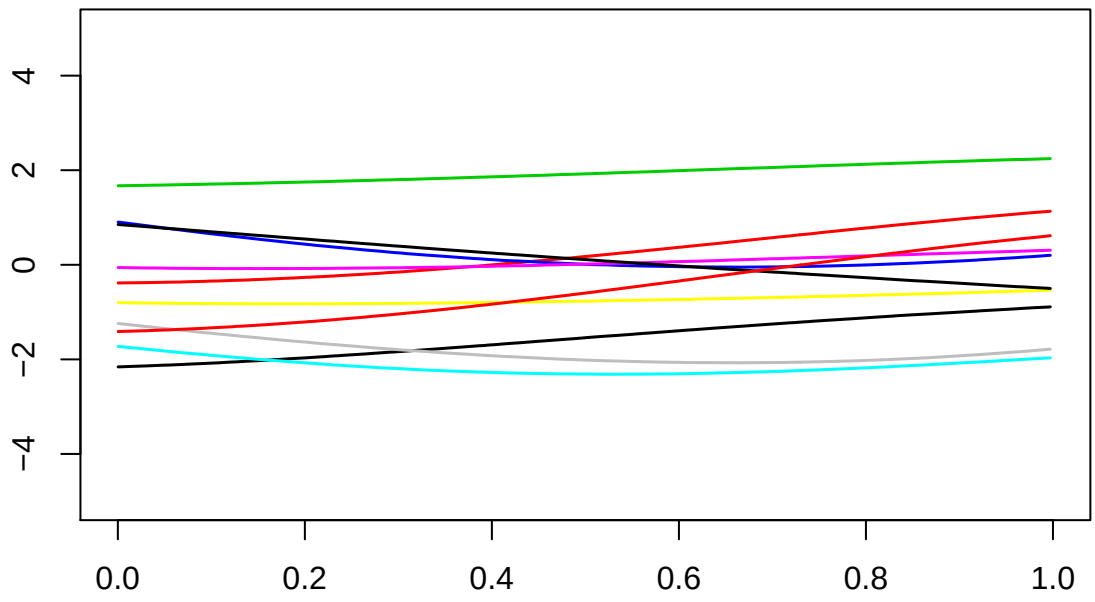
Sampling from Gaussian Process

```
library(mvtnorm)

d_euclid <- function(x,x_p){
  return(abs(x-x_p))
}
se_cov <- function(tao_2_1,tao_2_2,b,d_func,x){
  Sigma <- matrix(NA,length(x),length(x))
  for(i in 1:length(x)){
    for(j in 1:length(x)){
      Sigma[i,j] <- tao_2_1*exp(-(1/2)*(d_func(x[i],x[j])/b)^2)+tao_2_2*(x[i]==x[j])
    }
  }
  return(Sigma)
}
get_f_samples <- function(x,b,tao_2_1,tao_2_2,d_func,cov_func,n_samples){
  m_x <- rep(0,length(x))
  Sigma <- cov_func(tao_2_1,tao_2_2,b,d_euclid,x)

  mat_f <- matrix(NA,nrow= n,ncol=n_samples)
  for(i in 1:n_samples){
    mat_f[,i] <- rmvnorm(1,mean=m_x,sigma=Sigma)
  }
  return(mat_f)
}
n_samples <- 10
n <-100
x <- runif(n,0,1)
tao_2_2 <- 1e-06
idx_x <- order(x)
```

Square Exponential Covariance Function

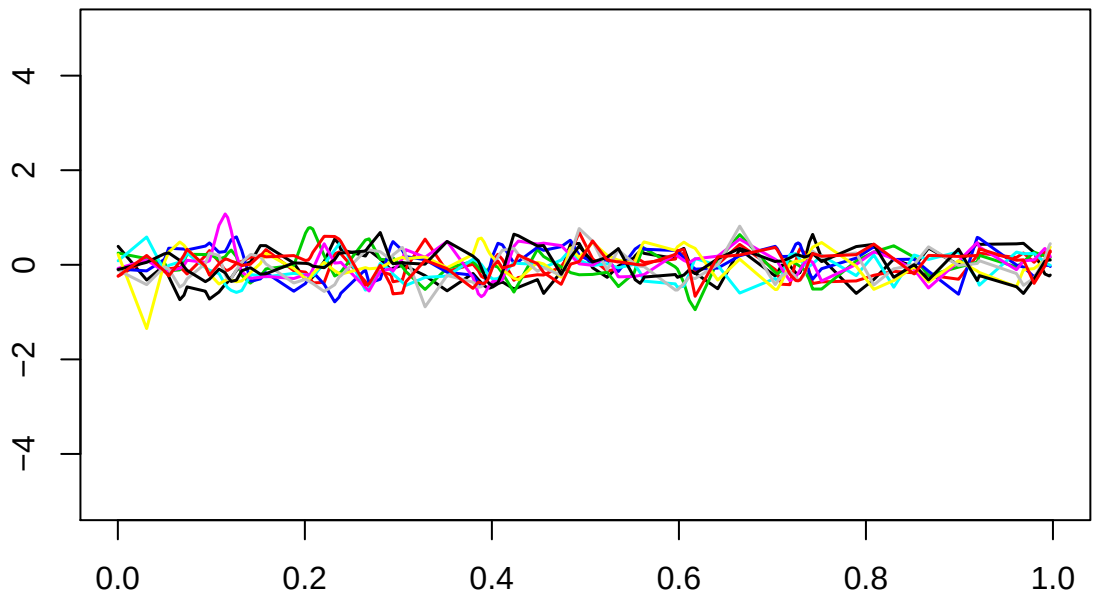
High b/High tao_1

```
high_b_high_t1 <- get_f_samples(x,b=1,2,tao_2_2,d_euclid,se_cov,n_samples)
plot(1, type="n", xlab="", ylab="", xlim=c(0, 1), ylim=c(-5,5))
for(i in 1:n_samples){
  lines(x[idx_x],high_b_high_t1[,i][idx_x],col=i,lwd=1.5)
}
```



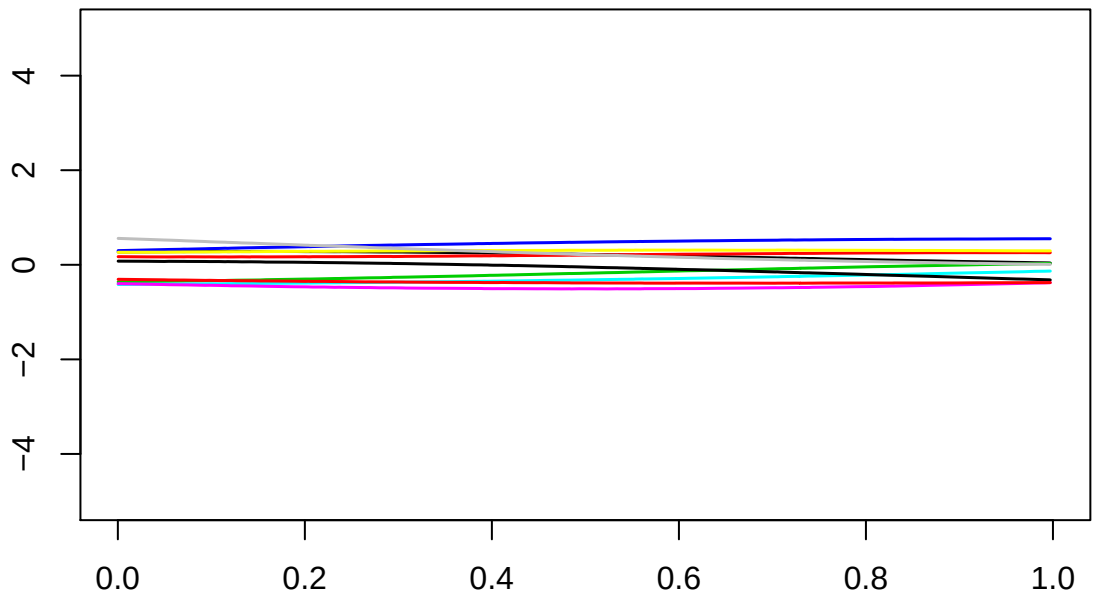
Low b/Low tao_1

```
low_b_low_t1 <- get_f_samples(x,b=0.01,0.1,tao_2_2,d_euclid,se_cov,n_samples)
plot(1, type="n", xlab="", ylab="", xlim=c(0, 1), ylim=c(-5,5))
for(i in 1:n_samples){
  lines(x[idx_x],low_b_low_t1[,i][idx_x],col=i,lwd=1.5)
}
```



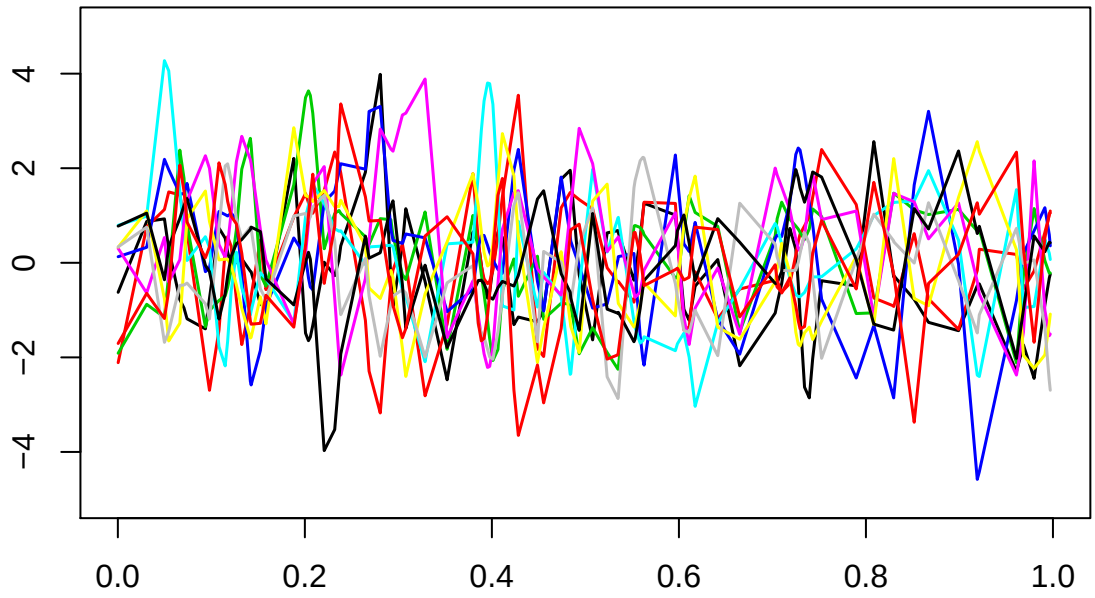
High b/Low tao_1

```
high_b_low_t1 <- get_f_samples(x,b=1,0.1,tao_2_2,d_euclid,se_cov,n_samples)
plot(1, type="n", xlab="", ylab="", xlim=c(0, 1), ylim=c(-5,5))
for(i in 1:n_samples){
  lines(x[idx_x],high_b_low_t1[,i][idx_x],col=i,lwd=1.5)
}
```



Low b/High tao_1

```
low_b_high_t1 <- get_f_samples(x,b=0.01,2,tao_2_2,d_euclid,se_cov,n_samples)
plot(1, type="n", xlab="", ylab="", xlim=c(0, 1), ylim=c(-5,5))
for(i in 1:n_samples){
  lines(x[idx_x],low_b_high_t1[,i][idx_x],col=i,lwd=1.5)
}
```

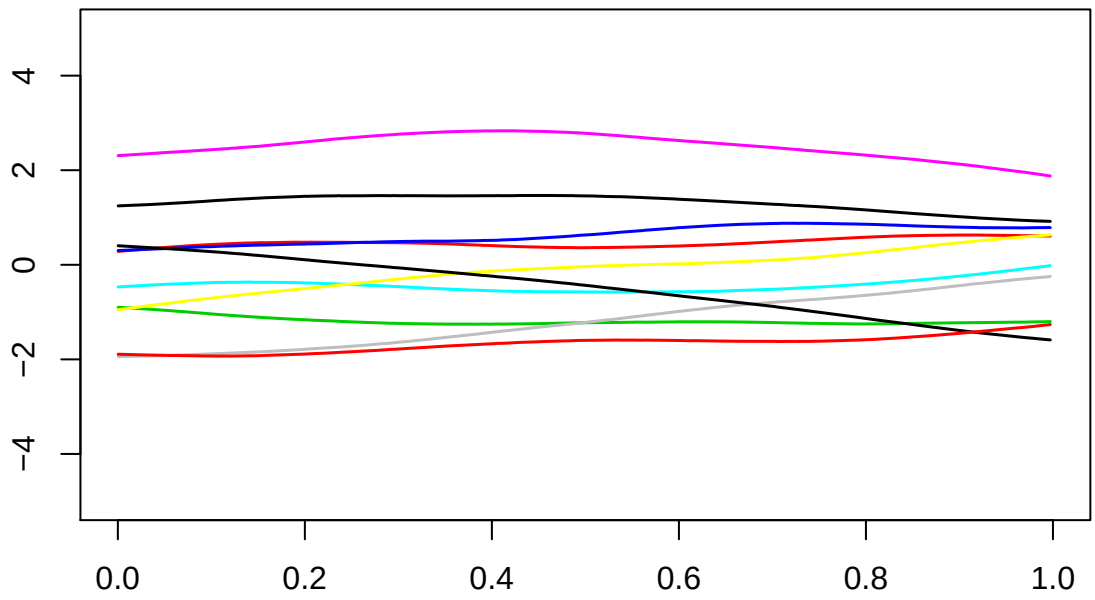


Matern 52

```
matern_52_cov <-  function(tao_2_1,tao_2_2,b,d_func,x){
  Sigma <- matrix(NA,length(x),length(x))
  for(i in 1:length(x)){
    for(j in 1:length(x)){
      d <- d_func(x[i],x[j])
      Sigma[i,j] <- tao_2_1*(1+sqrt(5)*(d/b)+(5/3)*(d/b)^2)*exp(-sqrt(5)*(d/b))+ tao_2_2*(x[i]==x[j])
    }
  }
  return(Sigma)
}
```

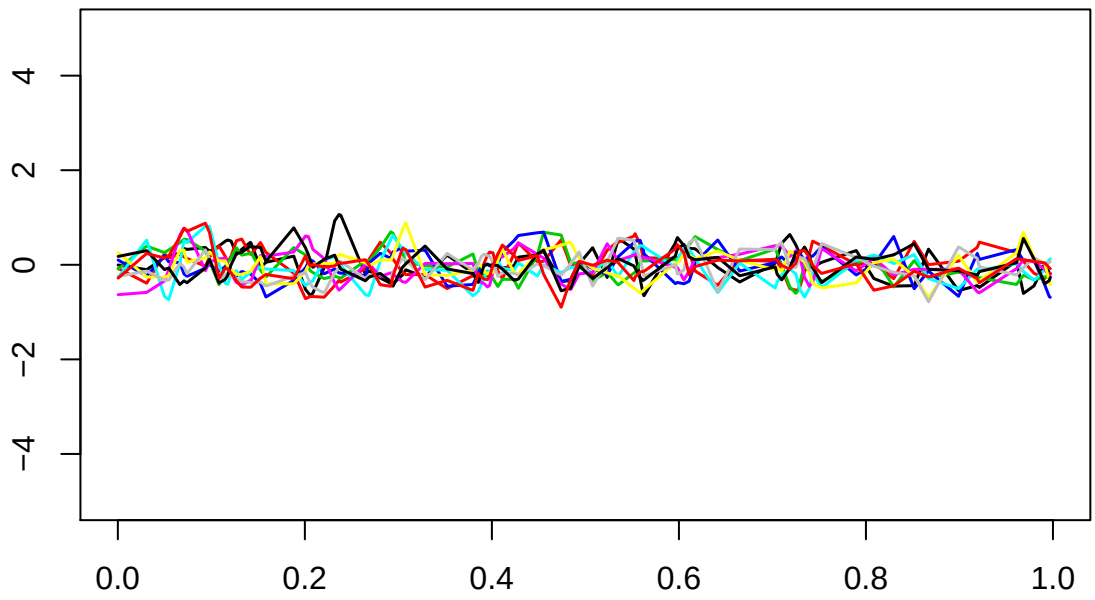
High b/High tao_1

```
high_b_high_t1 <- get_f_samples(x,b=1,2,tao_2_2,d_euclid,matern_52_cov,n_samples)
plot(1, type="n", xlab="", ylab="", xlim=c(0, 1), ylim=c(-5,5))
for(i in 1:n_samples){
  lines(x[idx_x],high_b_high_t1[,i][idx_x],col=i,lwd=1.5)
}
```



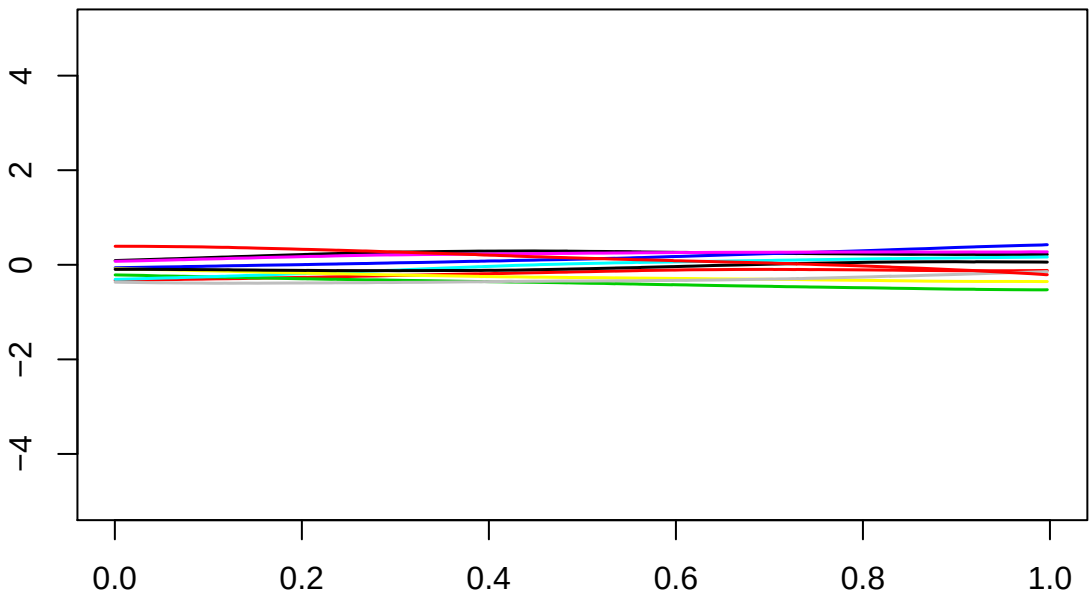
Low b/Low tao_1

```
low_b_low_t1 <- get_f_samples(x,b=0.01,0.1,tao_2_2,d_euclid,matern_52_cov,n_samples)
plot(1, type="n", xlab="", ylab="", xlim=c(0, 1), ylim=c(-5,5))
for(i in 1:n_samples){
  lines(x[idx_x],low_b_low_t1[,i][idx_x],col=i,lwd=1.5)
}
```



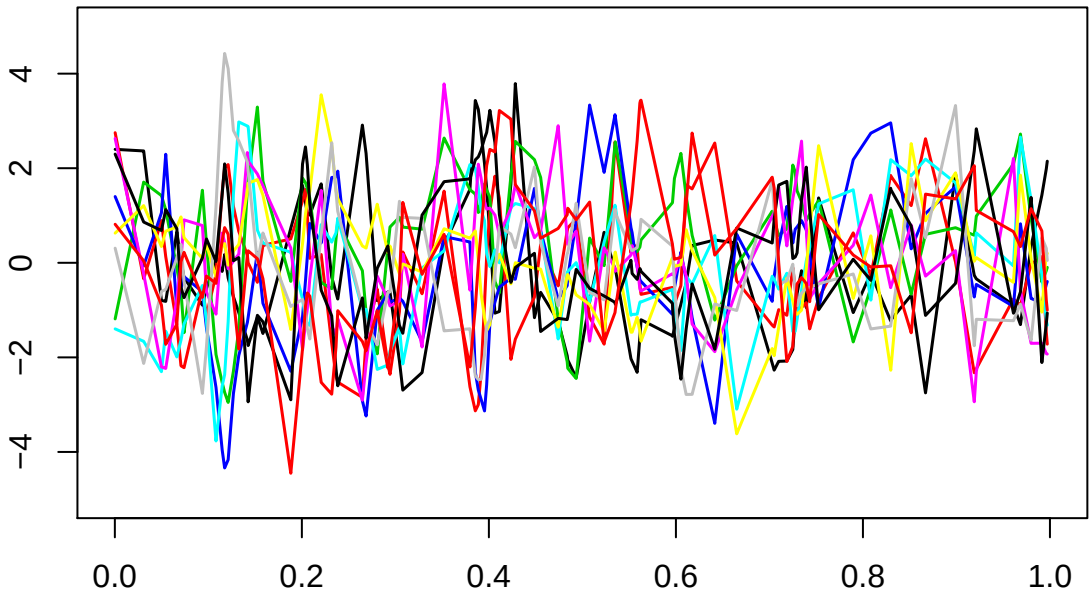
High b/Low tao_1

```
high_b_low_t1 <- get_f_samples(x,b=1,0.1,tao_2_2,d_euclid,matern_52_cov,n_samples)
plot(1, type="n", xlab="", ylab="", xlim=c(0, 1), ylim=c(-5,5))
for(i in 1:n_samples){
  lines(x[idx_x],high_b_low_t1[,i][idx_x],col=i,lwd=1.5)
}
```



Low b/High tao_1

```
low_b_high_t1 <- get_f_samples(x,b=0.01,2,tao_2_2,d_euclid,matern_52_cov,n_samples)
plot(1, type="n", xlab="", ylab="", xlim=c(0, 1), ylim=c(-5,5))
for(i in 1:n_samples){
  lines(x[idx_x],low_b_high_t1[,i][idx_x],col=i,lwd=1.5)
}
```


4
2
0
−2
−4
0.0
0.2
0.4
0.6
0.8
1.0