AR(2) Model Analysis

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Model Definitions

We examine two AR(2) models: 1. $X_t = 0.25X_{t-2} + W_t$ 2. $X_t = -0.9X_{t-2} + W_t$

Roots of the Autoregressive Polynomials

```
# Calculate roots for both models
roots_model1 <- polyroot(c(1, 0, -0.25))
roots_model2 <- polyroot(c(1, 0, 0.9))

# Display the roots
cat("Roots for Model 1 (X_t = 0.25X_{t-2} + W_t):", roots_model1, "\n\n")
```

```
## Roots for Model 1 (X_t = 0.25X_{t-2} + W_t): 2+0i -2+0i
```

```
cat("Roots for Model 2 (X_t = -0.9X_{t-2} + W_t):", roots_model2, "\n")
```

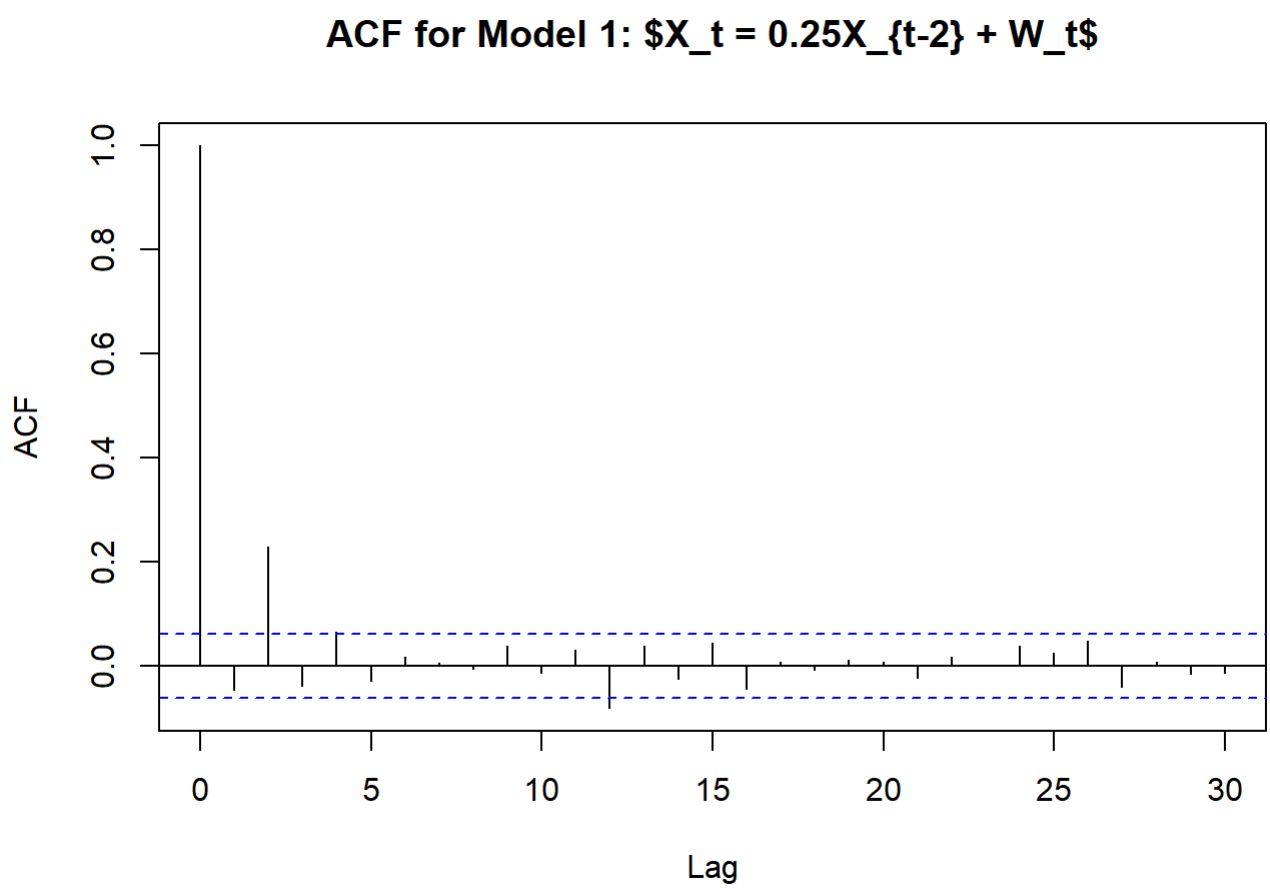
```
## Roots for Model 2 (X_t = -0.9X_{t-2} + W_t): 0+1.054093i 0-1.054093i
```

Autocorrelation Function (ACF)

The autocorrelation function for an AR(2) model with real or complex roots can be computed. Here, we simulate data for each model and compute the ACF.

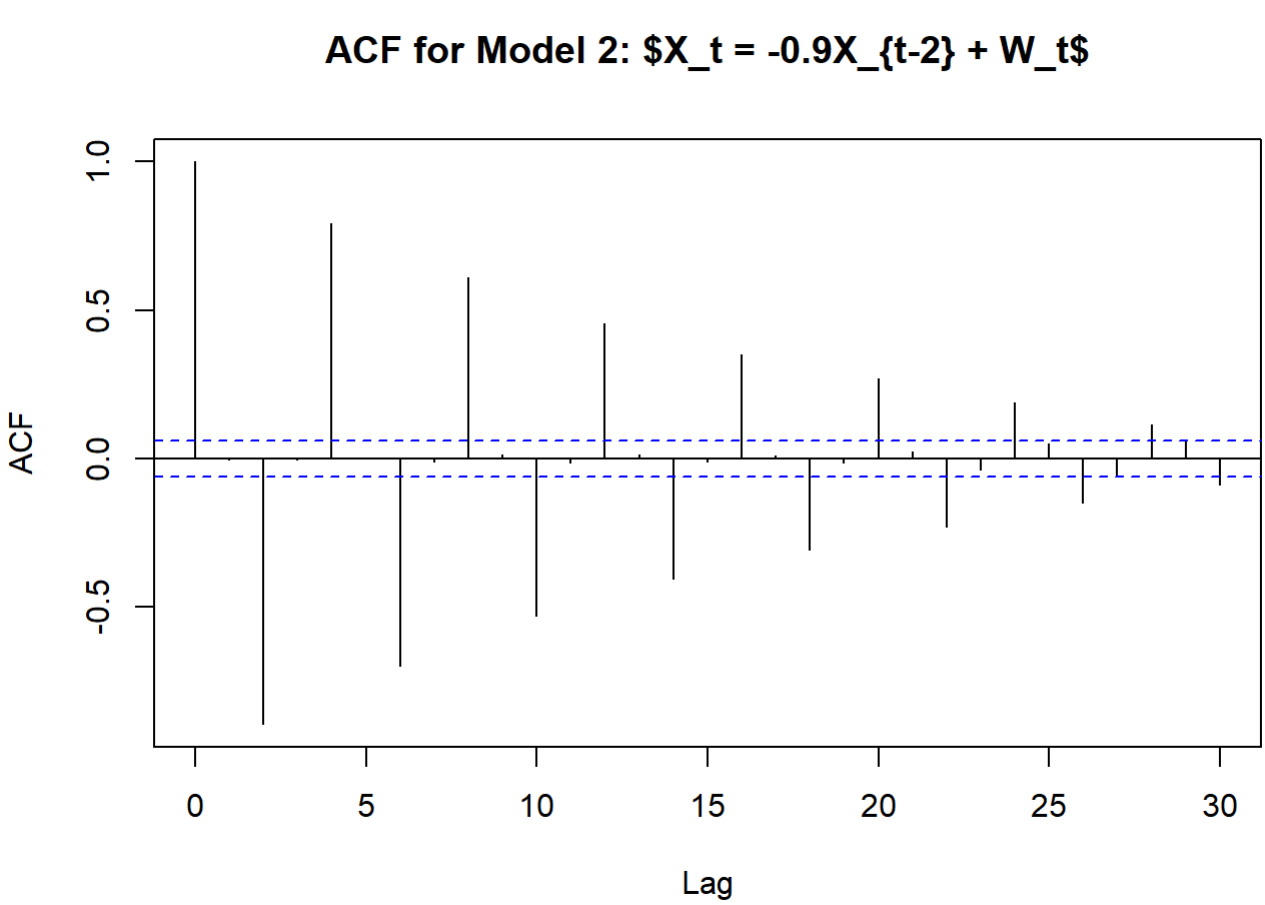
Simulation and ACF for Model 1

```
# Simulate AR(2) process for Model 1
set.seed(123)
model1 <- arima.sim(n = 1000, model=list(ar=c(0, 0.25)))

# Plot ACF
acf(model1, main="ACF for Model 1: $X_t = 0.25X_{t-2} + W_t$")
```



Simulation and ACF for Model 2

```
# Simulate AR(2) process for Model 2
set.seed(123)
model2 <- arima.sim(n = 1000, model=list(ar=c(0, -0.9)))

# Plot ACF
acf(model2, main="ACF for Model 2: $X_t = -0.9X_{t-2} + W_t$")
```


ACF for Model 2: $X_t = -0.9X_{t-2} + W_t$
ACF
1.0
0.5
0.0
-0.5
0
5
10
15
20
25
30
Lag