

The Program CONGRESS.PAS

The procedures of this program are either self-explanatory or else they are explained in the appropriate places by short texts displayed on the computer screen.

The inputs to the program are protected. Thus, for example, if the procedure to plot a periodogram is activated before any data has been provided and before the parameters of the graph have been declared, then the program will ask the user to provide these items.

The program is also protected against inappropriate inputs. Thus, if a non-numeric symbol is typed when a bounded integer has been called for, then the program will persist in asking for the integer until one that satisfies the bounds has been provided.

The graphs that are generated by the program are written to the screen in accordance with the chosen dimensions or page parameters. There are options to generate the *PostScript* code of the graphs. This is provided either as an encapsulated *PostScript* code or as a code that is compatible with the *Textures* typesetting program.

The following is a summary of the main menus of the program. Each item of the main menu of CONGRESS.PAS subsumes a sub-menu:

CONGRESS.PAS: Frequency-Limited ARMA Processes

1. Page Parameters
2. Specify an ARMA Model
3. Get the Data, Plot the Data, Transform the Data
4. Polynomial Detrending and Lowpass Filtering
5. Plot the Periodogram
6. ARMA Estimation
7. Plot the Spectral Density
8. Analysis of the ARMA Models
9. SAVE and EXIT

1. SPECIFY THE PAGE PARAMETERS

Do you want to output in PostScript?

Do you want a TeXtures Format?

Specify the frame surrounding the graph.

$(5\text{cm} \times 3\text{cm}) \leq (\text{width} \times \text{height}) \leq (13.5\text{cm} \times 9.5\text{cm})$

For two diagrams per page use 9cm times 6cm

For three diagrams per page use 9cm times 3.75cm

2. SPECIFY AN ARMA MODEL

1. Specify roots of the polynomial operator in polar form
2. Specify roots of the polynomial operator in Cartesian form
3. Specify the coefficients of the polynomial operator

3. GET THE DATA, PLOT THE DATA, TRANSFORM THE DATA

1. Read the Data
2. Generate Ordinary ARMA Data
3. Generate Frequency-Limited ARMA Data
4. Plot the Data
5. Take Logs of the Data
6. Subsample the Data
7. RETURN to the Main Menu

4. POLYNOMIAL DETRENDING AND LOWPASS FILTERING

1. Extract a Polynomial Trend
2. Apply a Lowpass Trigonometrical Filter
3. RETURN to the Main Menu

5. PLOT THE PERIDOGRAM

1. The Slow Peridogram
2. The Fast Peridogram

6. ARMA ESTIMATION

1. Specify the order of the estimated AR component
2. Impose MA zeroes at the zero and/or the Nyquist frequencies
3. Specify the order of an unrestricted MA component

7. PLOT THE SPECTRUM

1. Plot the spectrum of the specified ARMA model
2. Pseudo-Random Data. Plot the spectrum of the process generating the data together with that of the estimated model
3. Empirical Data. Plot the spectrum of the estimated model together with the periodogram of the data

8. ANALYSIS OF THE ARMA MODELS

1. The Parameters of the Specified Model
2. The Parameters of the Estimated Model

9. SAVE AND EXIT

1. Save the Data
2. Save the Specified ARMA Model
3. Save the Estimated ARMA Model
4. RETURN to the Main Menu
5. EXIT the Program

The Program in Use

The following listing demonstrates the use of the program in estimating a frequency-limited ARMA(2, 1) model from the data contained in the file *ECOSTA.txt*. Only a limited subset of the available procedures of the program are used in this example.

The inputs required of the user are indicated by the longrightarrows: \longrightarrow .

CONGRESS.PAS: Frequency-Limited ARMA Processes

1. Page Parameters
 \longrightarrow 1

SPECIFY THE PAGE PARAMETERS

Do you want to output in PostScript?
 \longrightarrow N

Specify the width
 \longrightarrow 99 *{for maximum width}*

Specify the height
 \longrightarrow 99 *{for maximum height}*

CONGRESS.PAS: Frequency-Limited ARMA Processes

3. Get the Data, Plot the Data, Transform the Data
 \longrightarrow 3

GET THE DATA

1. Read the Data
 \longrightarrow 1

Name the new data file =

→ ECOSTA.txt

NAME THE DATA

Do you wish to rename the data

→ N

GET THE DATA

7. RETURN to the Main Menu

→ 7

CONGRESS.PAS: Frequency-Limited ARMA Processes

5. Plot the Periodogram

→ 5

PLOT THE PERIODOGRAM

1. The Slow Peridogram

→ 1

To Continue, Close the Window and Press ⟨RETURN⟩

→ [×], ←

CONGRESS.PAS: Frequency-Limited ARMA Processes

3. Get the Data, Plot the Data, Transform the Data

→ 3

GET THE DATA

6. Subsample the Data

→ 6

SUBSAMPLE THE DATA

(a) Subsample the data, taking one in n points

Select 2, 3, 4 etc or type 1 to avoid subsampling.

→ 4

GET THE DATA

7. RETURN to the Main Menu

→ 7

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6. ARMA Estimation

→ 6

TEST FOR STATIONARITY

⟨RETURN⟩
→ ↔

AUTOREGRESSIVE (AND MOVING-AVERAGE) ESTIMATION

What is the order of the estimated autoregressive component?
→ 2

Do you wish to impose zeros at the zero or Nyquist frequency
→ Y

IMPOSE MOVING-AVERAGE ZEROS

1. Impose a zero at zero frequency
→ 1

CALCULATE THE AUTOCOVARIANCES

Type (c) for circular autocovariances (a) for ordinary autocovariances
→ c

THE MOVING-AVERAGE PARAMETERS

mu[0]= 1.0
mu[0]= -1.0

THE AUTOREGRESSIVE ESTIMATES

alpha[0]= 1.0
alpha[1]= -0.7282
alpha[2]= 0.5708
⟨RETURN⟩
→ ↔

CONGRESS.PAS: Frequency-Limited ARMA Processes

5. Plot the Periodogram
→ 5

PLOT THE PERIODOGRAM

1. The Slow Periodogram
→ 1

(e) Plot the periodogram of the data and the parametric spectrum
of the model estimated from the data
→ e

To Continue, Close the Window and Press $\langle \text{RETURN} \rangle$
 $\longrightarrow [\times], \leftarrow$

CONGRESS.PAS: Frequency-Limited ARMA Processes

9. SAVE and EXIT
 $\longrightarrow 9$

SAVE AND EXIT

5. EXIT the Program
 $\longrightarrow 5$

Compiling the Program

The Program has been compiled with the *Free Pascal* compiler on a *Windows* platform. *Free Pascal* compilers exist for a wide variety of platforms. The instruction *FPC MAIN* is sufficient for compiling the code that has been provided in the current folder. The code of the program is contained in 12 units, which are compiled in the following order:

1. GLOBALS
2. MATHS
3. UTILS
4. SCREEN
5. POST
6. ROOTS
7. SPECTRAL
8. ACQUIRE
9. AUTOREG
10. DATA
11. ORGANISE
12. MAIN

The resulted program will be named *MAIN.EXE*.