



## FREE OF CHARGE SOFTWARE LICENSE

### « RARL2 »

**BETWEEN :** **L'INSTITUT NATIONAL DE RECHERCHE EN INFORMATIQUE  
ET EN AUTOMATIQUE**  
*NATIONAL INSTITUTE FOR RESEARCH IN COMPUTER  
SCIENCE AND AUTOMATIC CONTROL*  
Public corporation of a scientific and technological nature, governed by the  
French decree Nr 85-831 of August the 2<sup>nd</sup>. 1985

Having its registered office at:  
Domaine de Voluceau - Rocquencourt  
BP 105  
78153 LE CHESNAY CEDEX

Represented by its President and Chief Executive Officer, Mr Michel  
COSNARD and by Mr Gerard GIRAUDON, Director of the Sophia  
Antipolis Research Centre, who is acting on due authority for the  
purposes of this Agreement

Hereinafter referred to as "INRIA"

On one hand,

**AND:** **Company** \_\_\_\_\_

Having its registered office at: \_\_\_\_\_  
\_\_\_\_\_

Represented by Mr/Mrs (*person authorised to sign*) \_\_\_\_\_

in its quality of (*function*) \_\_\_\_\_.

Hereinafter referred to as "the Beneficiary"

On the other hand,

The technical supervisors are:

For INRIA: Mrs Martine OLIVI (martine.olivi@sophia.inria.fr)

For the Beneficiary: \_\_\_\_\_ (email: \_\_\_\_\_)

## **IT WAS PREVIOUSLY STATED :**

- Whereas INRIA agents, within the APICS research team led by Mr Laurent BARATCHART and Centre de Mathématiques Appliquées de l'Ecole Nationale Supérieure des Mines de Paris (ARMINES) have jointly developed the RARL2 software.
- Whereas the software's copyrights are shared equally between INRIA and ARMINES
- Whereas the RARL2 SOFTWARE version v-1.0 dated 2004, January the 1<sup>st</sup> has been registered with the Agence de Protection des Programmes (APP) under the number IDDN.FR.001.340003.001.S.P.2002.000.31235.
- Whereas a co-ownership agreement about the above-mentioned software has been signed by INRIA and ARMINES on the 21<sup>st</sup> of December 2006, whose provisions allow the co-owners to grant non exclusive licences to third parties.
- Whereas the software's description is mentioned in the technical appendix.
- Whereas the Beneficiary wishes to use the software for academic research purposes only.

## **THE FOLLOWING AGREEMENT HAS BEEN ENTERED TO:**

### **ARTICLE 1 – DEFINITIONS**

**SOFTWARE:** refers to the RARL2 V1.0 software. The technical description of the SOFTWARE is detailed in the appendix. The SOFTWARE RARL2 V1.0 comprises the matlab executable code and its associated documentation.

**TECHNICAL DOCUMENTATION:** designates the documentation provided with the matlab executable code.

**USE:** means the loading of the program within a computer's memory and total or partial processing of the program with the goal of the progress and execution of the commands contained therein, complying with the uses described in the TECHNICAL DOCUMENTATION.

**ERROR:** any incident, anomaly or bug happening while using the SOFTWARE according to its TECHNICAL DOCUMENTATION provisions.

### **ARTICLE 2 - PURPOSE**

**2.1** INRIA authorises the Beneficiary to USE, according to the conditions listed below, the SOFTWARE described in the technical appendix.

The SOFTWARE's matlab executable code will be delivered to the Beneficiary.

This agreement is concluded only for **academic research purposes, excluding any other usage such as commercial use.**

This license is a non-exclusive and non-transferable authorisation, and confers only a USE right to the Beneficiary.

This authorisation concerns current version of the SOFTWARE RARL2 (Version V1.0)

**2.2** This agreement shall not in any case imply a total or partial transfer to a third party, either in return for remuneration or free-of-charge.

**2.3** The SOFTWARE will be exclusively used under the responsibility of the Beneficiary's technical supervisor as mentioned on the front page of this contract.

## ARTICLE 3 – INTELLECTUAL PROPERTY

**3.1** The Beneficiary recognizes that the copyrights on THE SOFTWARE RARL2 are held by INRIA and ARMINES and that this agreement does not involve any transfer of property for its benefit.

The Beneficiary will take all required measures to protect the copyright on the SOFTWARE. Therefore the Beneficiary undertakes to retain the copyright notice in the code of the SOFTWARE, as well as the name of the authors, physical person, INRIA and ARMINES' agents.

The Beneficiary will respect these indications wherever they appear in the code, the compiled versions or in the TECHNICAL DOCUMENTATION supplied by INRIA.

The Beneficiary will retain the name of the authors and the copyright notice in any back-up copy.

**3.2** In case of a SOFTWARE procedure of seizure, the Beneficiary undertakes to inform INRIA immediately by registered mail, to raise all formal protests required against the seizure and to take all necessary steps to make known the copyright on the SOFTWARE.

**3.3** In the event that the Beneficiary wishes to grant sublicenses under the SOFTWARE to third parties, it recognizes that these actions require the express and prior authorisation of INRIA.

Such actions will be stated in a separate agreement between the parties which will describe the term and condition of such commercial use.

## ARTICLE 4 – CONDITIONS OF USE

**4.1** THE SOFTWARE must be USED according to its destination, excluding any other, for **academic research purposes only**, in compliance with the TECHNICAL DOCUMENTATION.

**4.2** According to the terms and conditions of article 122-5 of the French Intellectual Property Code, the Beneficiary is authorised to make a back-up copy to protect the USE of the SOFTWARE.

**4.3** According to the terms and conditions of article 335-3 of the French Intellectual Property Code, the Beneficiary recognizes that any USE not in compliance with the above-mentioned terms and conditions shall constitute a breach of the right to USE the SOFTWARE, and shall represent an infringement of copyright.

In particular, the Beneficiary is prohibited from carrying out:

- Any reproduction other than the one mentioned in article 4.2.
- Any other intervention on the SOFTWARE, with other finality than those of article 2.1.
- Any sublicense of the SOFTWARE to third party without prior agreement of INRIA.

## ARTICLE 5 – TECHNICAL SUPERVISORS

Both INRIA and the Beneficiary have nominated a technical supervisor, designated on the front page of this contract, for the follow-up of this agreement.

The parties reserve the right to nominate another supervisor later.

When one of the parties does so, it will inform the other party in writing. This letter will be addressed to the technical supervisor of the other party.

## **ARTICLE 6 – DELIVERY OF THE SOFTWARE**

**6.1** INRIA undertakes to send to the Beneficiary a copy of the SOFTWARE in the form of matlab executable code.

**6.2** The Beneficiary undertakes to acknowledge the receipt of the SOFTWARE as follows:

- By registered mail addressed to the address below, within eight (8) days of its delivery by INRIA.

INRIA Sophia Antipolis Méditerranée  
Service Administratif et Financier  
Att : Martine Boissonnat et Martine Olivi  
2004, route des lucioles  
BP 93, 06902 Sophia-Antipolis  
France

Or

- By registered electronic mail, addressed to INRIA's technical supervisor designated on the front page ([martine.olivi@sophia.inria.fr](mailto:martine.olivi@sophia.inria.fr)) and to INRIA's administrative and financial office manager ([martine.boissonnat@sophia.inria.fr](mailto:martine.boissonnat@sophia.inria.fr)) within twenty four (24) hours of its delivery by INRIA.

## **ARTICLE 7 – COMMITMENTS OF THE BENEFICIARY**

**7.1** The Beneficiary undertakes to fully mention the SOFTWARE's name and origin in any publication featuring results obtain by USE of the SOFTWARE.

**7.2** The Beneficiary undertakes to notify INRIA of ERRORS or any other defect of the SOFTWARE it discovers during USE.

**7.3** The Beneficiary undertakes to inform INRIA of any loss or destruction of the SOFTWARE and/or of its TECHNICAL DOCUMENTATION.

## **ARTICLE 8 – GUARANTEE – MAINTENANCE - LIABILITY**

**8.1** The SOFTWARE is a research prototype. The Beneficiary is therefore responsible of making sure that its technical characteristics and functionalities fit its needs.

The parties agree that INRIA does not offer any guarantee to the Beneficiary concerning the proper functioning of the SOFTWARE.

**8.2** INRIA shall not provide any maintenance relating to the SOFTWARE.

**8.3** The parties expressly agree that in no case INRIA shall be declared liable for any direct or indirect damage suffered by the Beneficiary as a result of the USE of the SOFTWARE, as well as any difficulty experienced during its USE or for it being impossible to USE.

## **ARTICLE 9 - DURATION**

This agreement will have a duration of three (3) years.  
It will be entered into at the date of signing of the last party.

The agreement may be renewed through an amendment.

## **ARTICLE 10 – FINANCIALS CONDITIONS**

No object.

## **ARTICLE 11 – DEFAULT - CANCELLATION**

In case the Beneficiary fails to carry out its obligations, and in particular its obligation to protect the SOFTWARE, INRIA will have the possibility of cancelling this agreement ipso jure without legal formalities.

## **ARTICLE 12 – RESTITUTION –DESTRUCTION OF THE SOFTWARE**

In case the contractual relationship between the parties breaks off for default or cancellation mentioned in article 11, the Beneficiary undertakes to return to INRIA all elements composing the SOFTWARE delivered to him.

Within a maximum of one (1) month from the end of the contractual relationship, the Beneficiary **undertakes to destroy the SOFTWARE as well as its back-up copy**, without regard to the format under which it is kept.

Within this delay of one (1) month from the end of the contractual relationship, the Beneficiary will establish, sign and send a certificate certifying the restitution and/or the destruction of the SOFTWARE and of any copy in its possession:

- Either by registered mail addressed to the address below,

INRIA Sophia Antipolis Méditerranée  
Service Administratif et Financier  
Att : Martine Boissonnat and Martine Olivi  
2004, route des lucioles  
BP 93, 06902 Sophia-Antipolis  
France

- Or by registered electronic mail, addressed to INRIA's technical supervisor designated on the front page ([martine.olivi@sophia.inria.fr](mailto:martine.olivi@sophia.inria.fr)) and to INRIA's administrative and financial office manager ([martine.boissonnat@sophia.inria.fr](mailto:martine.boissonnat@sophia.inria.fr)) within twenty four (24) hours of its delivery by INRIA.

## **ARTICLE 13 - CONFIDENTIALITY**

The Beneficiary expressly agrees to regard as confidential the creations protected by the Intellectual Property Law as well as the elements of know-how of INRIA or any and all information communicated to the Beneficiary as confidential.

The Beneficiary undertakes to make the SOFTWARE available for its employees (or people reporting to it) who require such availability, and to inform them that the SOFTWARE is subject to confidentiality, and having agreed to use the SOFTWARE according to the provisions of this agreement.

The Beneficiary undertakes to take all appropriate measures towards its employees (or people reporting to it) to ensure the confidentiality of the elements and data considered in this article.

The Beneficiary recognizes that any non-expressly authorised disclosure would seriously damage the interests of INRIA.

The commitments listed in this article shall remain in full force and effect for a duration of ten (10) years after the end of this agreement.

## **ARTICLE 14 – SETTLEMENT OF DISPUTES**

Any dispute relating to the interpretation or the performance of the licence herein, which cannot be settled amicably, shall be submitted to the court of les Yvelines, France.

Made in two (2) originals.

### **The Beneficiary:**

Name :

Title

Date :

Signature :

### **INRIA :**

Gérard GIRAUDON

Director of the Sophia Antipolis Research  
Centre

Date :

Signature :

## TECHNICAL APPENDIX

The software RARL2 computes a stable rational L2-approximation of specified order  $n$  to a given stable (analytic in the complement of the unit disk) matrix function. This can be the transfer function of a multivariable discrete-time stable system.

This function can be given in one of the following forms

- 1) a realization
- 2) its Fourier coefficients
- 3) pointwise values on the unit circle; in that case, a least square criterion is used instead of the L2 norm.

This software allows to perform model reduction (case 1 and 2) and frequency data identification (case 3). In that case, the criterion is less robust than the L2 norm and the result is very dependent on the quality of data. If it fails to be good enough, it can be necessary to first approximate the data by a large degree stable function (bounded extremal problems can be used).

An appropriate Moebius transformation allows to use the software for continuous-time systems as well.

Language: MATLAB + toolkit OPTIM + toolkit CONTROL

The main function is the function arl2.

Input arguments

1. The data to be approximate in one of the possible forms
2. An initial system (for the optimization) in state-space form. The order of the approximant will be the McMillan degree of this system.
3. Options ('rtype' can take the value "real" or "complex" according to the type of the data)
4. Optimization options (maximum number of iterations allowed, termination tolerance on the function value ...)

Output arguments: a structure containing information about the optimization

1. the best approximant (state-space form, parameters of the associated stable allpass system)
2. optimisation output arguments (number of iterations taken, value of the objective function at the solution, ...)

The number of local minima can be rather high so that the choice of an initial point for the optimization can play a crucial role.

Two methods can be used:

- 1) compute a best hankel approximant as initial system. This can be done using the function fc2ss from Fourier coefficients.
- 2) run the function RARL2 which proceeds to an iterative search from degree 1 to  $n$  : from a (local) minima at degree  $k$ , several (precise number can be specified by the user) initial systems of degree  $k+1$  can be computed. Starting the optimization from these points does improve the error obtained at degree  $k$ .