Report on AlgebraicLoops

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Part I

AlgebraicLoops

Chapter 1

aRC

1.1 aRC_abg.tex

MTT command:

```
mtt aRC abg tex
```

The acausal bond graph of system **aRC** is displayed in Figure 1.1 (on page 10) and its label file is listed in Section 1.1.1 (on page 9). The subsystems are listed in Section 1.1.2 (on page 12).

The system **aRC** is the simple electrical rc circuit shown in Figure 1.1 (on page 10). It can be regarded as a single-input single-output system with input e_1 and output e_2.

The two resistors (r_1 and r_2) are in series; this give an undercausal system with a corresponding algebraic loop. The loop is broken by adding the **SS** component "loop" to localise the algabraic equation byh choosing the corresponding flow such that the corresponding effort is zero. This algebraic equation appears in Section 1.4 (on page 14).

This loop is algbraicly solved to give the ordinary differential equation of Section 1.5 (on page 15) and the transfer function of Section 1.6 (on page 15).

1.1.1 Summary information

System aRC::Simple RC circuit example with algebraic loop

Interface information:

This component has no ALIAS declarations

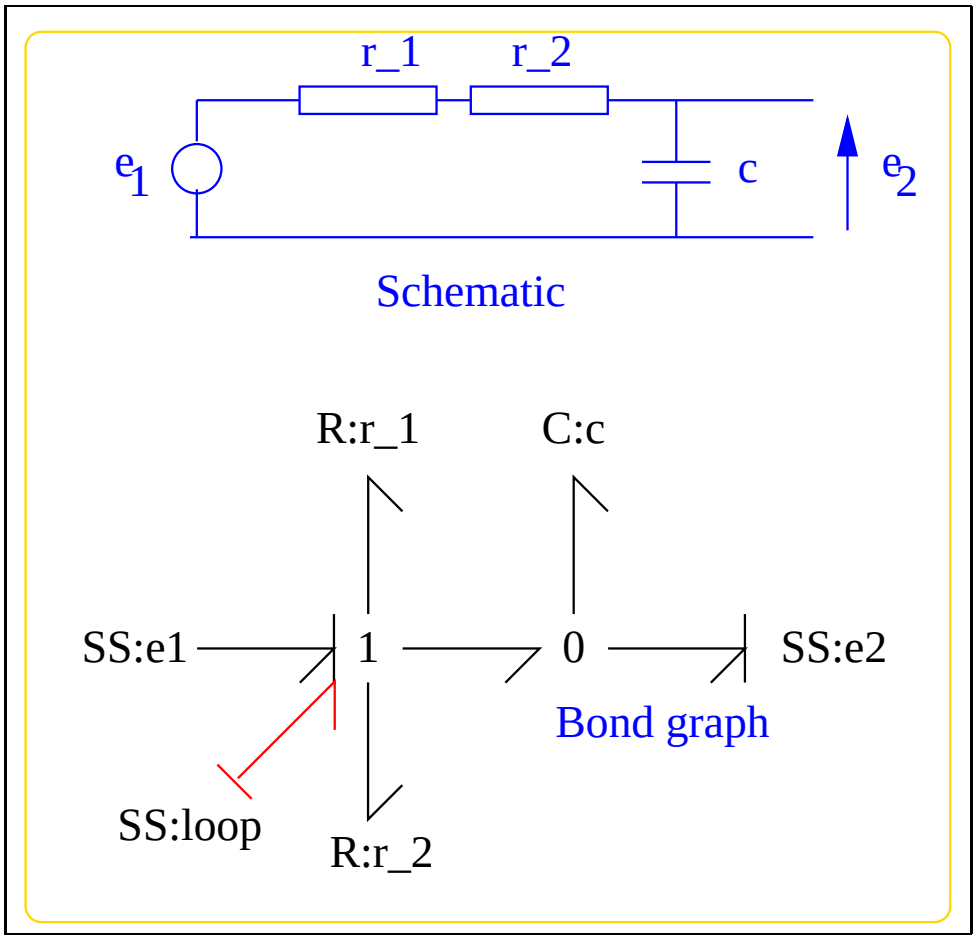

Figure 1.1: System **aRC**: acausal bond graph

Variable declarations:

This component has no PAR declarations

Units declarations:

This component has no UNITs declarations

The label file: aRC_lbl.txt

```
%SUMMARY aRC: Simple RC circuit example with algebraic loop

%% Label file for system aRC (aRC_lbl.txt)

% %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% %% Version control history
% %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% %% $Id: aRC_lbl.txt,v 1.1 2000/12/28 17:02:29 peterg Exp $
% %% $Log: aRC_lbl.txt,v $
% %% Revision 1.1  2000/12/28 17:02:29  peterg
% %% To RCS
% %%
% %% Revision 1.1  2000/05/20 16:03:15  peterg
% %% Initial revision
% %%
% %% Revision 1.1  1997/05/12  15:11:47  peterg
% %% Initial revision
% %%
% %% Revision 1.1  1997/04/18  13:27:54  peterg
% %% Initial revision
% %%
% %% Revision 1.1  1997/04/18  13:20:13  peterg
% %% Initial revision
% %% Revision 1.1  1996/09/10 11:37:14  peter
% %% Initial revision
% %%
% %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

%% Each line should be of one of the following forms:
% a comment (ie starting with %)
% Component-name CR_name arg1,arg2,..argn
% blank
```

```
% Source - effort source (e1) flow ignored
e1 SS external,internal

% Sensor - effort sensor (e2) zero flow
e2 SS external,0

% R component - linear with resistance r (effort = r*flow)
r_1 lin flow,r_1
r_2 lin flow,r_2

% C component - linear with capacitance c (state = c*effort)
c lin effort,c

% Algebraic loop SS
loop SS      zero,unknown
```

1.1.2 Subsystems

No subsystems.

1.2 aRC_cbg.ps

MTT command:

```
mtt aRC cbg ps
```

This representation is given as Figure 1.2 (on page 13).

1.3 aRC_struc.tex

MTT command:

```
mtt aRC struc tex
```

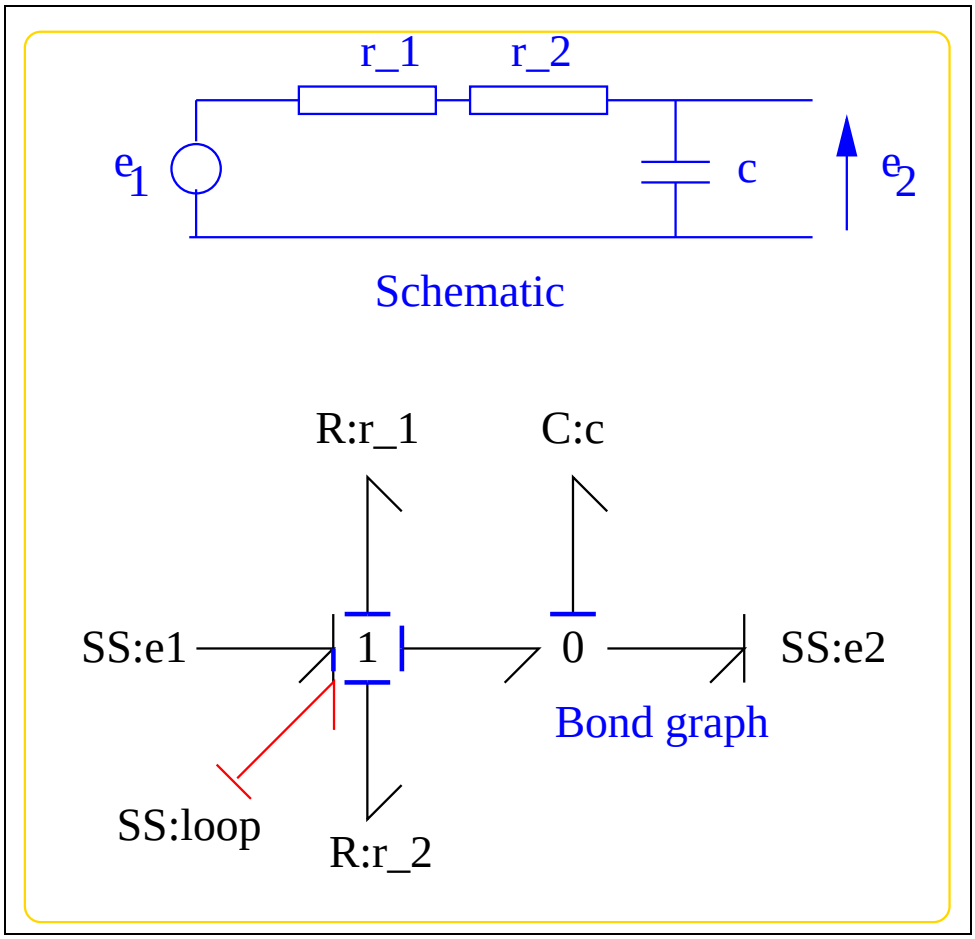

Figure 1.2: System **aRC**, representation cbg (-noargs)

List of inputs for system aRC			
	Component	System	Repetition
1	e1	aRC__e1	1

List of outputs for system aRC			
	Component	System	Repetition
1	e2	aRC__e2	1

List of states for system aRC			
	Component	System	Repetition
1	c	aRC__c	1

List of unknown_inputs for system aRC			
	Component	System	Repetition
1	loop	aRC__loop	1

List of zero_outputs for system aRC			
	Component	System	Repetition
1	loop	aRC__loop	1

1.4 aRC_dae.tex

MTT command:

```
mtt aRC dae tex
```

$$\dot{x}_1 = v_1 \tag{1.1}$$

$$0 = \frac{(-cu_1 + cv_1r_1 + cv_1r_2 + x_1)}{c} \tag{1.2}$$

$$y_1 = \frac{x_1}{c} \tag{1.3}$$

1.5 aRC_ode.tex *(-A)*

MTT command:

```
mtt -A aRC ode tex
```

$$\dot{x}_1 = \frac{(cu_1 - x_1)}{(c(r_1 + r_2))} \tag{1.4}$$

$$y_1 = \frac{x_1}{c} \tag{1.5}$$

1.6 aRC_tf.tex *(-A)*

MTT command:

```
mtt -A aRC tf tex
```

$$G = \left(\frac{1}{(cr_1 s + cr_2 s + 1)}\right) \tag{1.6}$$

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