Instituto Tecnológico
GeoMinero de España

ESTUDIO DE LAS CARACTERISTICAS DEL CALENTAMIENTO Y COMBUSTION ESPONTANEA EN CAPA DE LAS HULLAS SUBBITUMINOSAS PENINSULARES

ANEXOS 15 - 21

Septiembre, 1992

MINISTERIO DE INDUSTRIA, COMERCIO Y TURISMO

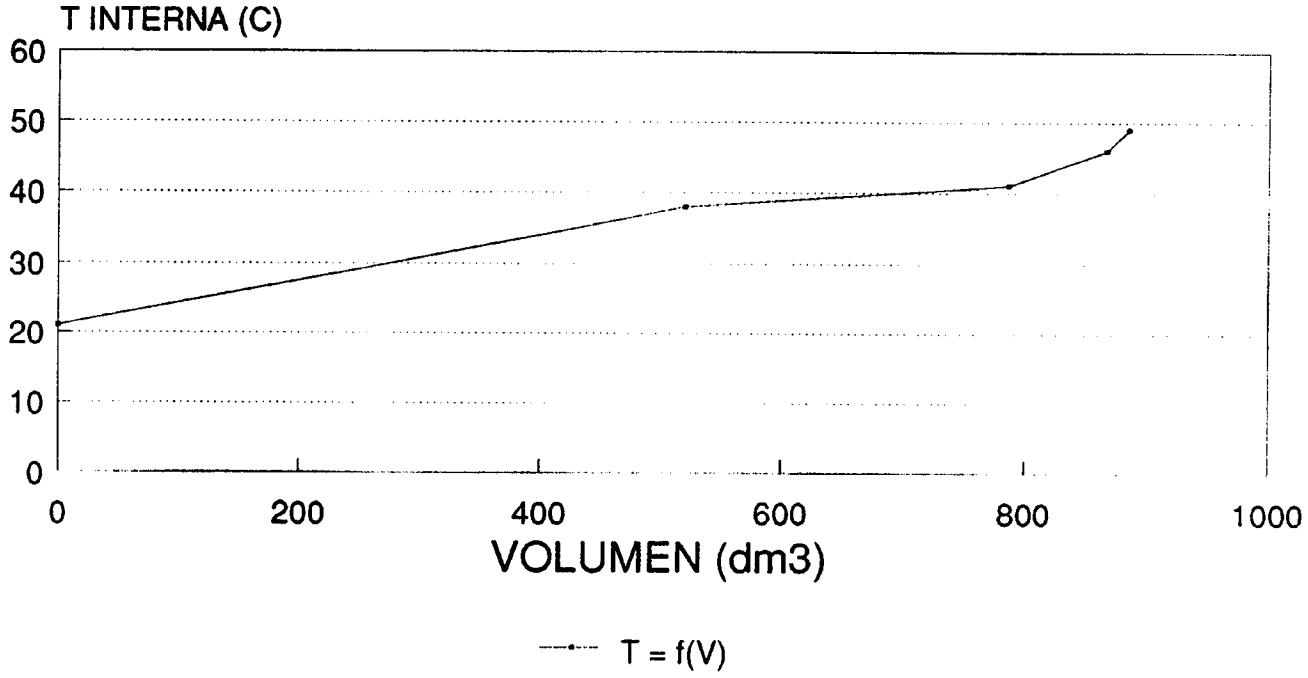
ANEXO 15

REPRESENTACIONES GRAFICAS RELACIONANDO VOLUMEN Y TEMPERATURAS INTERNAS EN LAS ACUMULACIONES DE CARBON

OPORTUNA

ACUMULACIONES DE CARBON

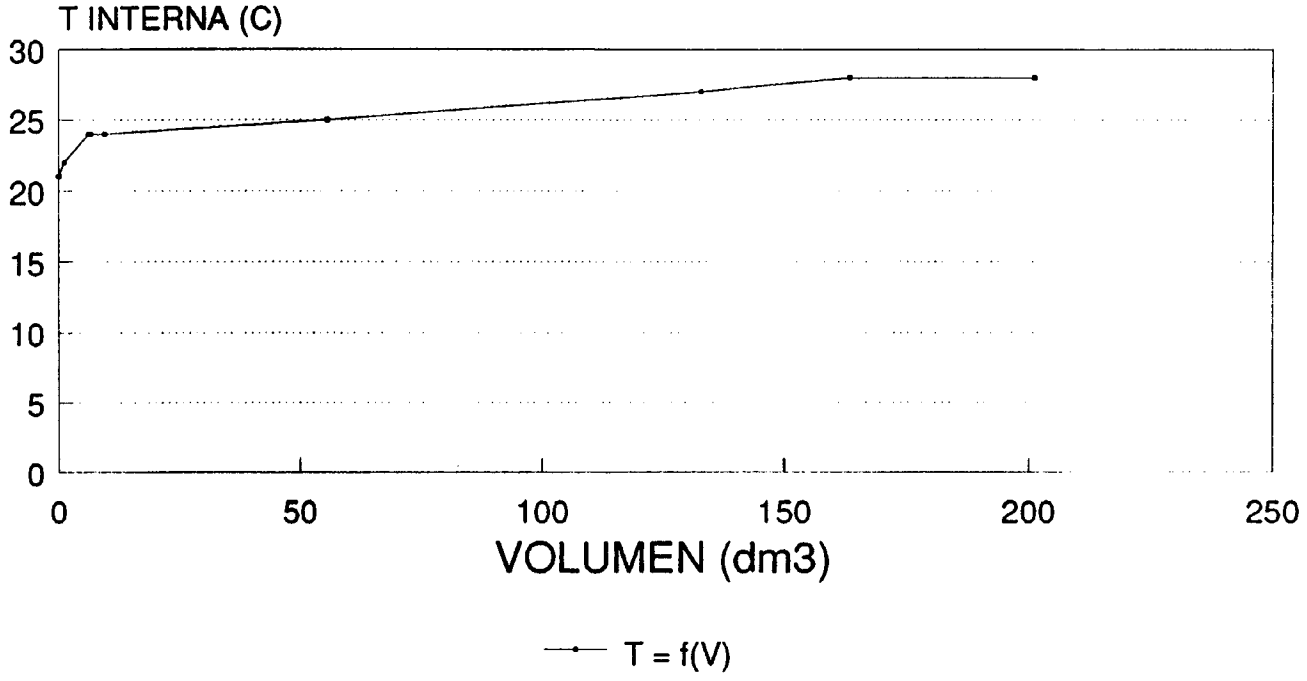
(TERMOPAR Nº 10)



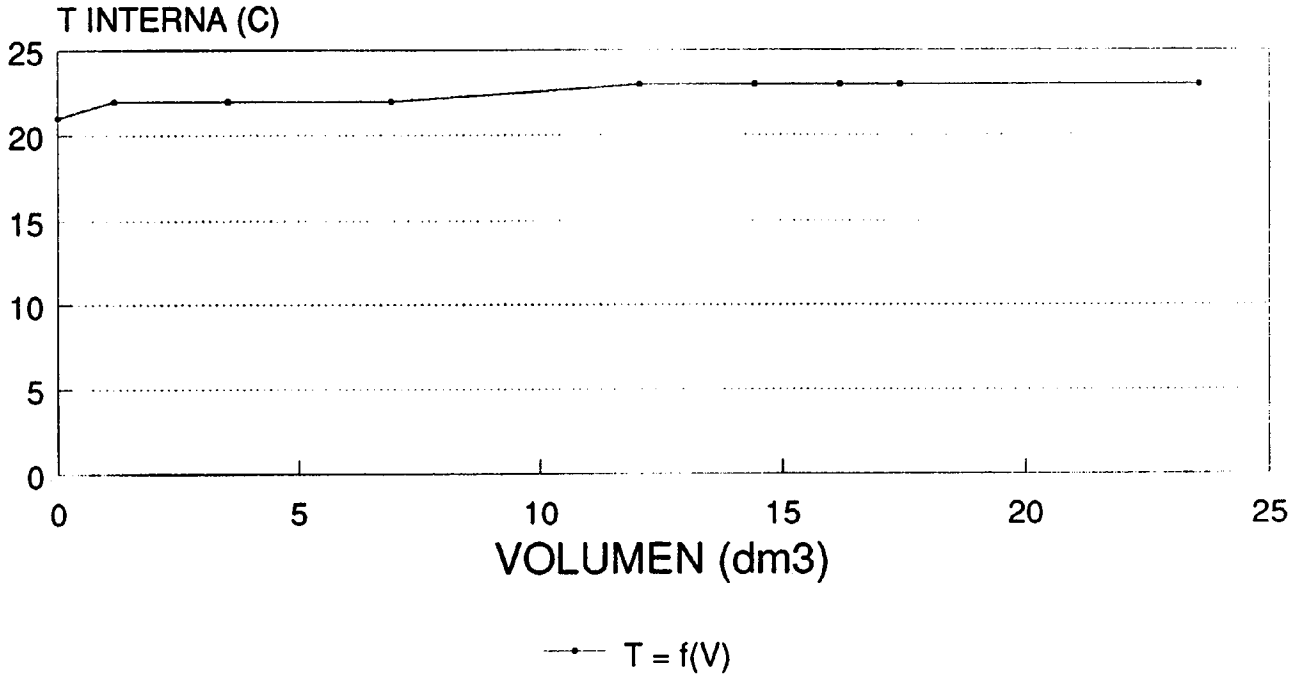
OPORTUNA

ACUMULACIONES DE CARBON

(TERMOPAR Nº 12)



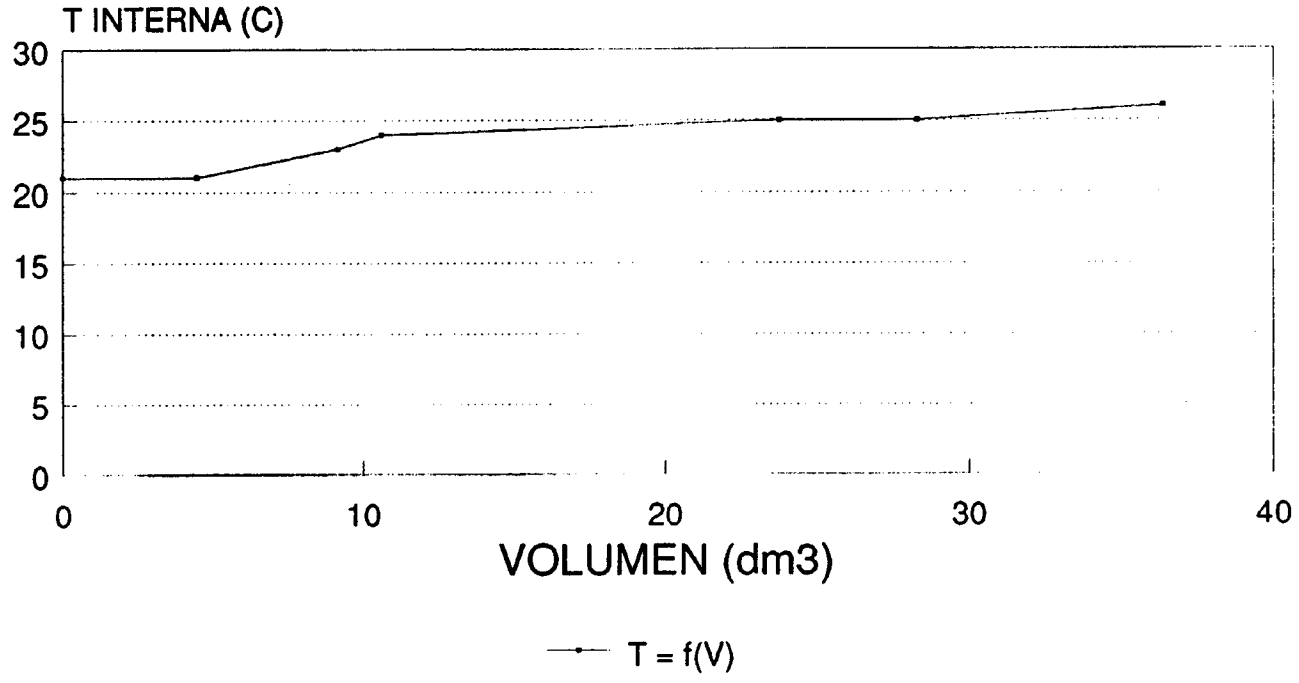
OPORTUNA
ACUMULACIONES DE CARBON
(TERMOPAR Nº 14)



OPORTUNA

ACUMULACIONES DE CARBON

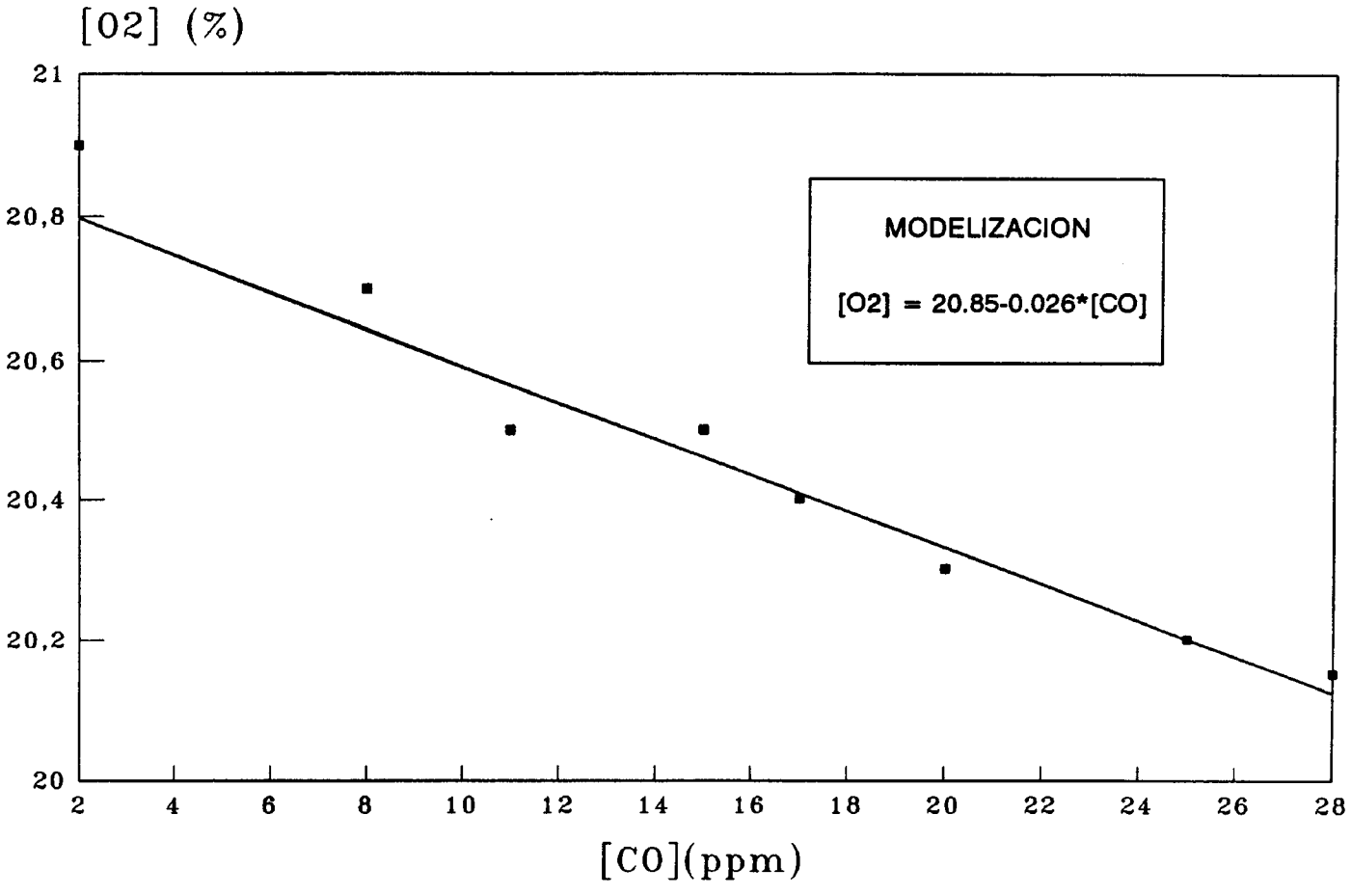
(TERMOPAR Nº 15)



ANEXO 16

REGRESIONES LINEALES DE LA PARADA DE VENTILACION 1 DEL NIVEL 3121. O_2= f (CO)

MINA OPORTUNA
NIVEL 3121. [02] = f[CO]



PARADA 1

NIVEL 3121.PARADA 1 ANALISIS DE LA REGRESION - MODELO LINEAL Y = a+bX

VARIABLE DEPENDIENTE : O2 (%) VARIABLE INDEPENDIENTE : CO (ppm)

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	20.8544	0.0496758	419.81	.00000
Slope	-0.026055	2.6244E-3	-9.92801	.00018

Analysis of Variance

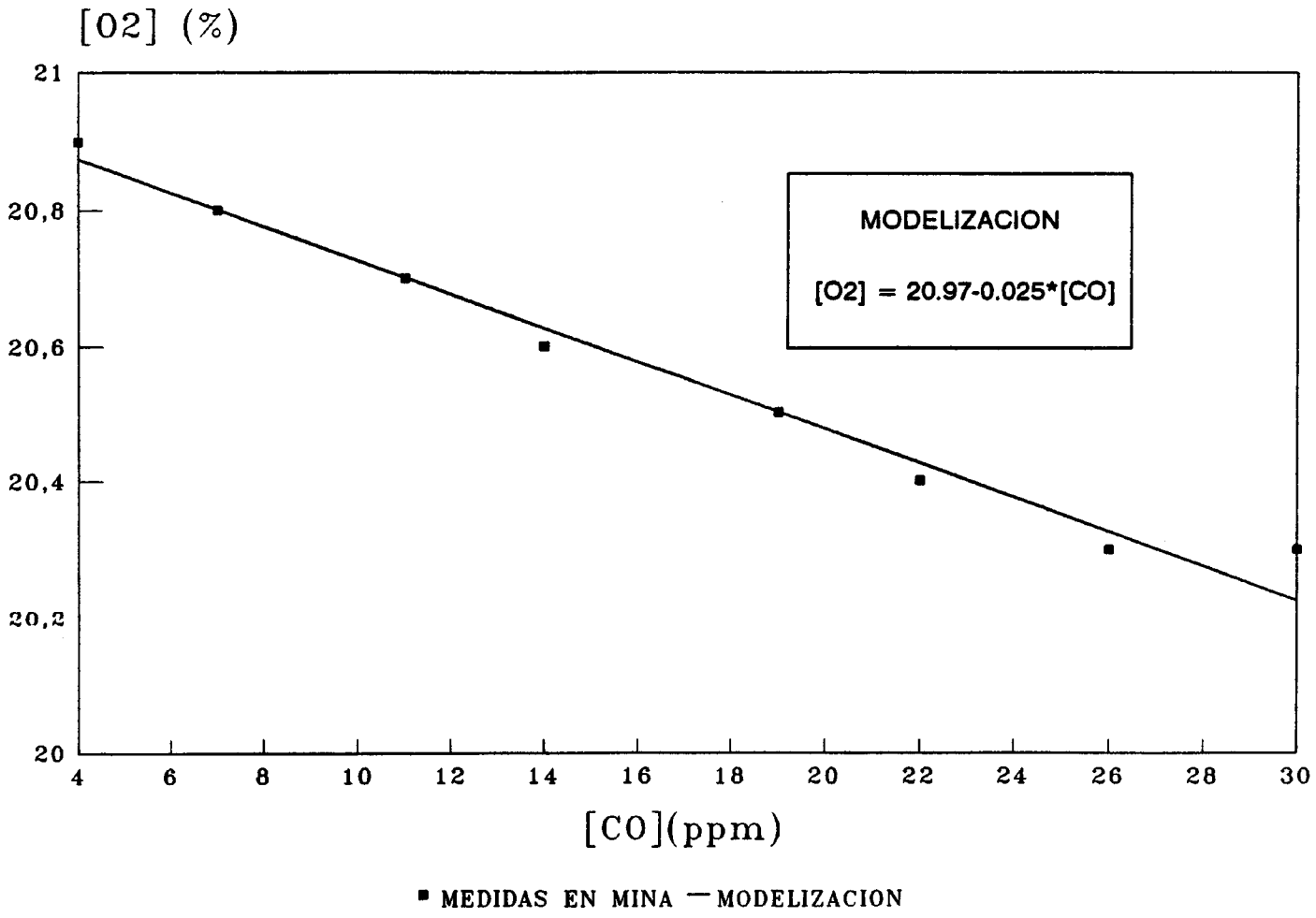
Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	.211418	1	.211418	98.56532	.00018
Error	.0107248	5	.0021450		
Total (Corr.)	.2221429	6			

Correlation Coefficient = -0.975562 R-squared = 95.17 %
Stnd. Error of Est. = 0.0463136

ANEXO 17

REGRESIONES LINEALES DE LA PARADA DE VENTILACION 2 DEL SUBNIVEL 3121. O_2= f(CO)

MINA OPORTUNA
NIVEL 3121. [02] = f[CO]



PARADA 2

NIVEL 3121.PARADA 2 ANALISIS DE LA REGRESION - MODELO LINEAL Y = a+bX

VARIABLE DEPENDIENTE : O2 (%) VARIABLE INDEPENDIENTE : CO (ppm)

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	20.9761	0.0252784	829.803	.00000
Slope	-0.0250581	1.20525E-3	-20.7908	.00000

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	.54014	1	.54014	432.2570	.00000
Error	.0087471	7	.0012496		
Total (Corr.)	.5488889	8			

Correlation Coefficient = -0.992 R-squared = 98.41 %
Stnd. Error of Est. = 0.0353495

ANEXO 18

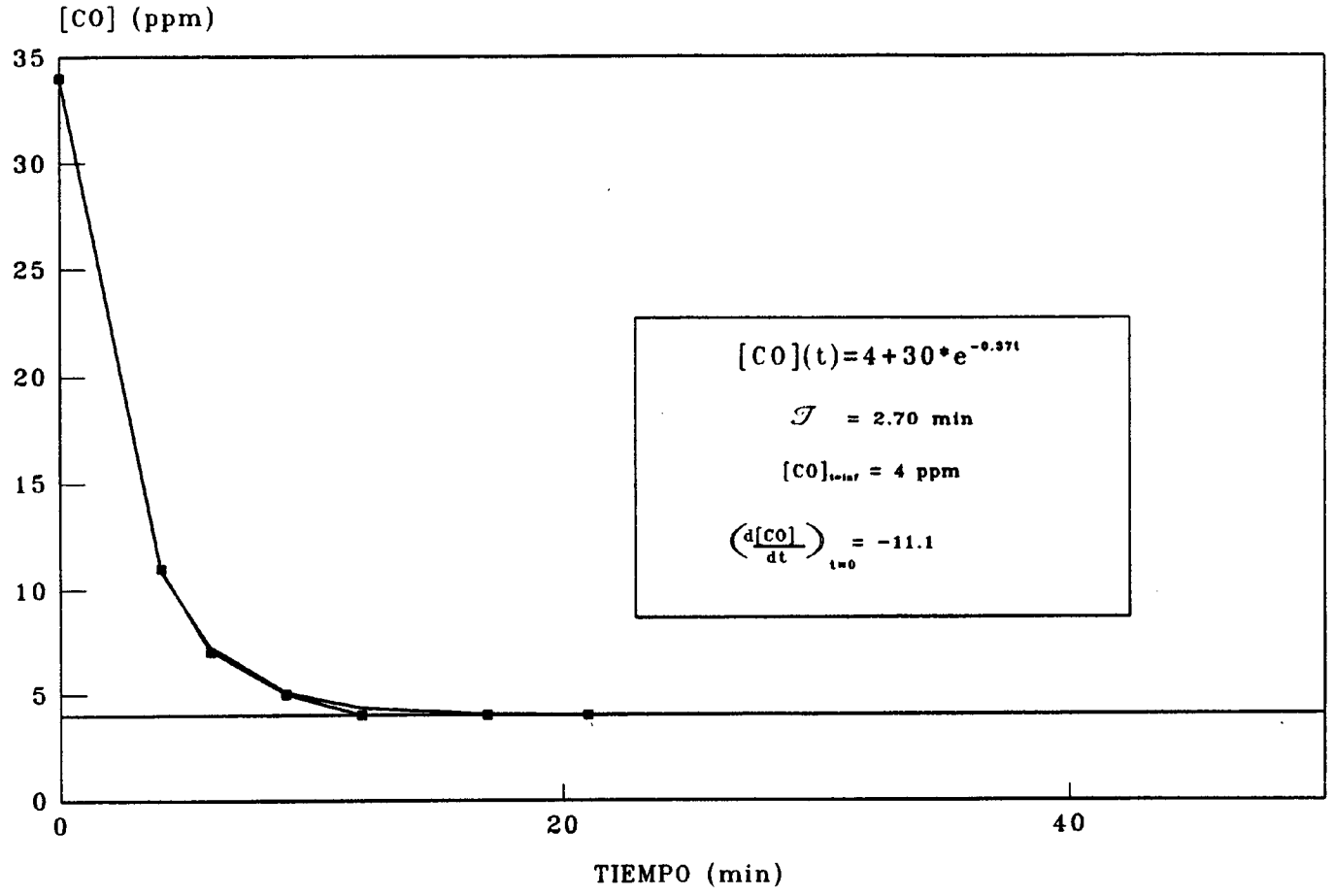
AJUSTES SOBRE SISTEMAS DE 1ER ORDEN DE LOS PARAMETROS MEDIDOS DESPUES DE LA PARADA DEL NIVEL 3121

ANEXO 18.1	**$CO = f(t)$**
ANEXO 18.2	**$O_2 = f(t)$**
ANEXO 18.3	**$T_s = f(t)$**
ANEXO 18.4	**$T_h = f(t)$**
ANEXO 18.5	**$H_r = f(t)$**

ANEXO 18.1

CO= f(t)

MINA OPORTUNA
EVOLUCION DE [CO]



VUELTA A LAS CONDICIONES INICIALES 3121

Nonlinear Regression

Dep. variable: PAR1EN21.CO

Parameter vector: 1 1

Function: 4+PARM[1]*30*EXP PARM[2]*(-0.37)*PAR1EN21.TIEMPO

Maximum iterations: 25
Maximum function calls: 200
Stopping cond. on res. ss: 1E-4
Stopping cond. on estimates: 1E-3

Initial Marquardt parameter: 0.01
Initial scaling factor: 20
Max. value of Marquardt parm.: 120

Analysis of Variance for the Full Regression

source	sum of squares	df	mean square	ratio
Model	1398.776	2	699.388	15627.377
Error	.2237702	5	.0447540	
Total	1399.0000	7		
Total (corr.)	718.85714	6		

R-squared = 0.999689

Model Fitting Results

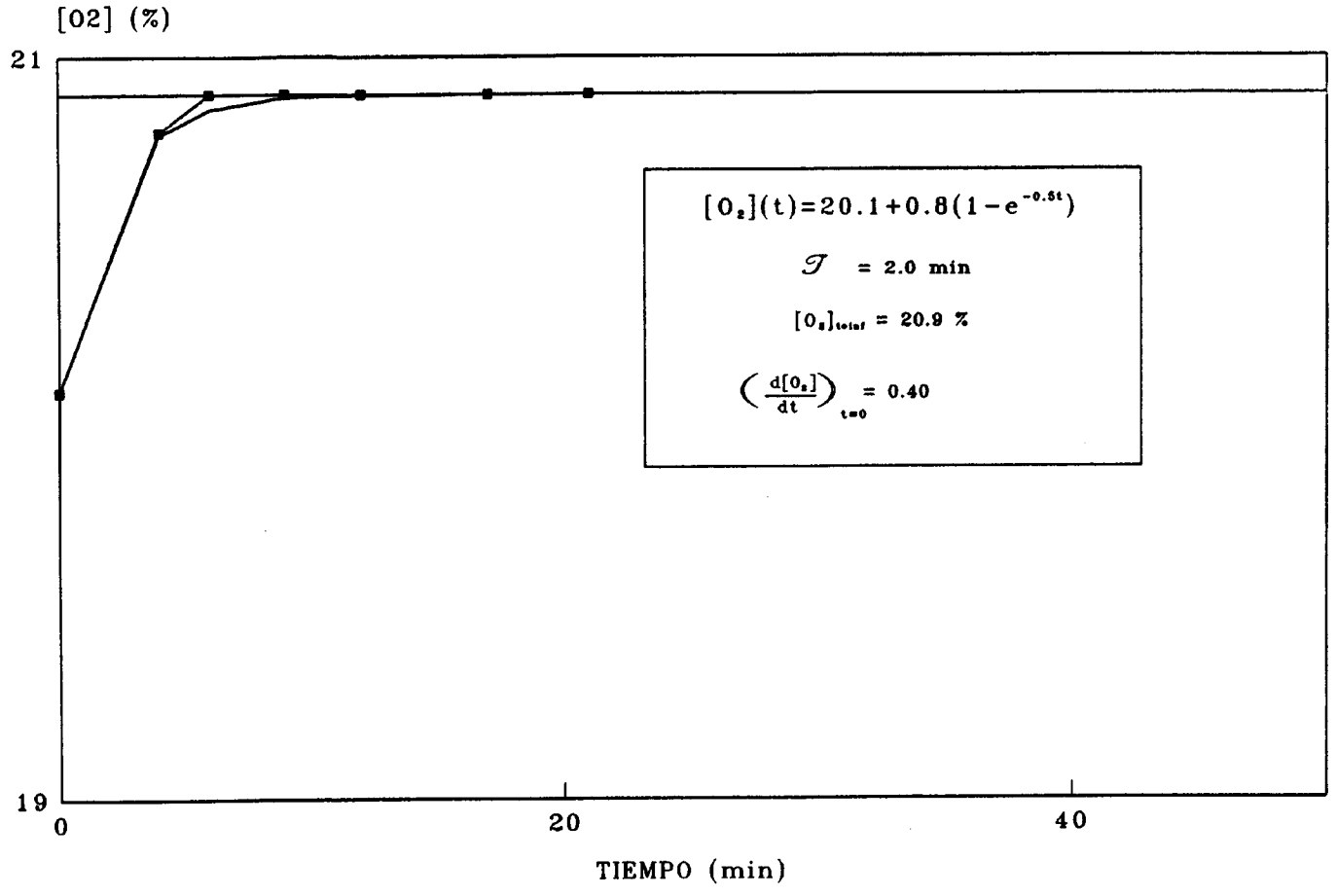
	estimate	stnd.error	ratio
Coefficient 1	1.00072729	.00704013	142.146
Coefficient 2	1.00609864	.01705519	58.991

Total iterations = 2 Total function evaluations = 7

ANEXO 18.2

$O_2 = f(t)$

MINA OPORTUNA
EVOLUCION DE [02]



VUELTA A LAS CONDICIONES INICIALES 3121

Nonlinear Regression

Dep. variable: PAR1EN21.O2

Parameter vector: 1 1

Function: 20.1+PARM[1]*0.8*(1-EXP PARM[2]*(-0.5)*PAR1EN21.TIEMPO)

Maximum iterations: 25
Maximum function calls: 200
Stopping cond. on res. ss: 1E-4
Stopping cond. on estimates: 1E-3

Initial Marquardt parameter: 0.01
Initial scaling factor: 20
Max. value of Marquardt parm.: 120

Analysis of Variance for the Full Regression

source	sum of squares	df	mean square	ratio
Model	3020.699	2	1510.350	99999.000
Error	.0009164	5	.0001833	
Total	3020.7000	7		
Total (corr.)	.5342857	6		

R-squared = 0.998285

Model Fitting Results

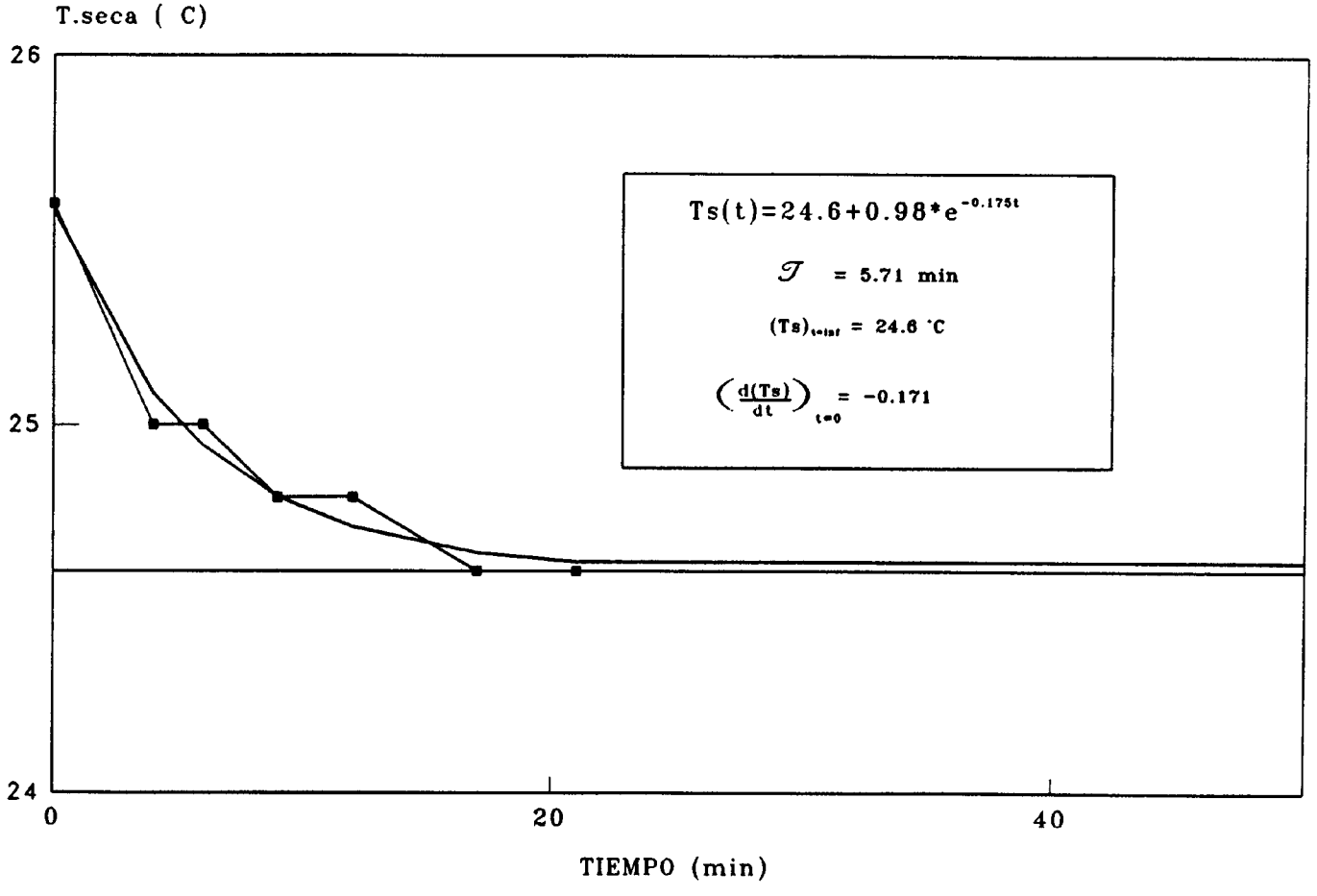
	estimate	stnd.error	ratio
Coefficient 1	1.00590173	.00869829	115.644
Coefficient 2	1.08348527	.08043985	13.470

Total iterations = 2 Total function evaluations = 7

ANEXO 18.3

$T_s = f(t)$

MINA OPORTUNA
EVOLUCION DE LA TEMPERATURA SECA



VUELTA A LAS CONDICIONES INICIALES 3121

Nonlinear Regression

Dep. variable: PAR1EN21.Tseca

Parameter vector: 1 1

Function: 24.6+PARM[1]*0.98*EXP PARM[2]*(-0.175)*PAR1EN21.TIEMPO

Maximum iterations: 25
Maximum function calls: 200
Stopping cond. on res. ss: 1E-4
Stopping cond. on estimates: 1E-3

Initial Marquardt parameter: 0.01
Initial scaling factor: 20
Max. value of Marquardt parm.: 120

Analysis of Variance for the Full Regression

source	sum of squares	df	mean square	ratio
Model	4345.739	2	2172.870	99999.000
Error	.0206853	5	.0041371	
Total	4345.7600	7		
Total (corr.)	.7085714	6		

R-squared = 0.970807

Model Fitting Results

	estimate	stnd.error	ratio
Coefficient 1	1.00235985	.06365513	15.7467
Coefficient 2	1.00096296	.11286217	8.8689

Total iterations = 2 Total function evaluations = 7

ANEXO 18.4

$T_h = f(t)$

Nonlinear Regression

Dep. variable: PAR1EN21.Thumeda

Parameter vector: 1 1

Function: 21.6+PARM[1]*3.2*EXP PARM[2]*(-0.22)*PAR1EN21.TIEMPO

Maximum iterations: 25
Maximum function calls: 200
Stopping cond. on res. ss: 1E-4
Stopping cond. on estimates: 1E-3

Initial Marquardt parameter: 0.01
Initial scaling factor: 20
Max. value of Marquardt parm.: 120

Analysis of Variance for the Full Regression

source	sum of squares	df	mean square	ratio
Model	3546.565	2	1773.283	77213.379
Error	.1148300	5	.0229660	
Total	3546.6800	7		
Total (corr.)	7.4285714	6		

R-squared = 0.984542

Model Fitting Results

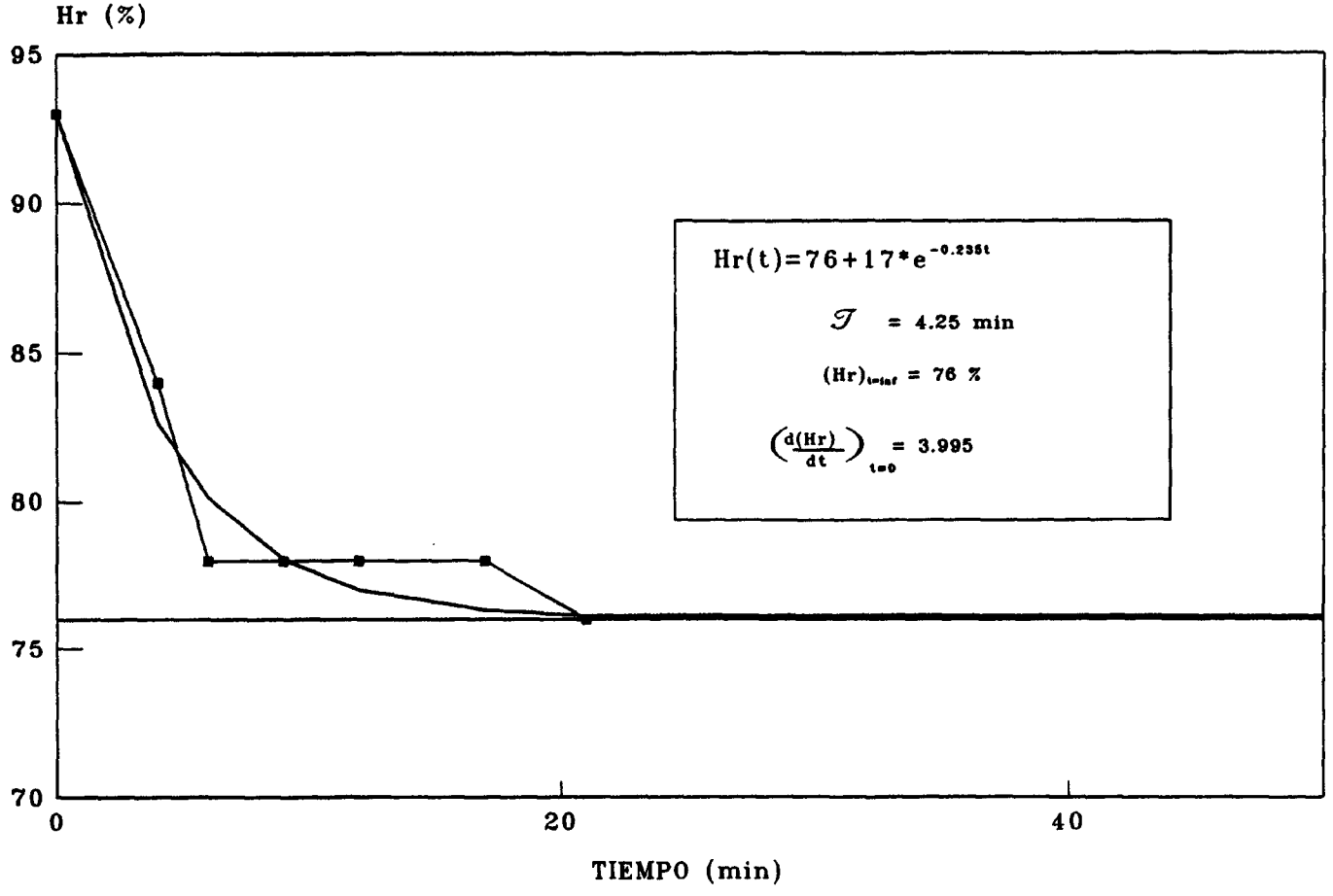
	estimate	stnd.error	ratio
Coefficient 1	.99915697	.04671268	21.3894
Coefficient 2	1.02663957	.08920177	11.5092

Total iterations = 2 Total function evaluations = 7

ANEXO 18.5

$H_r = f(t)$

MINA OPORTUNA
EVOLUCION DE LA HUMEDAD RELATIVA



VUELTA A LAS CONDICIONES INICIALES 3121

Nonlinear Regression

Dep. variable: PAR1EN21.Hr

Parameter vector: 1 1

Function: 76+PARM[1]*17*EXP PARM[2]*(-0.235)*PAR1EN21.TIEMPO

Maximum iterations: 25
Maximum function calls: 200
Stopping cond. on res. ss: 1E-4
Stopping cond. on estimates: 1E-3

Initial Marquardt parameter: 0.01
Initial scaling factor: 20
Max. value of Marquardt parm.: 120

Analysis of Variance for the Full Regression

source	sum of squares	df	mean square	ratio
Model	45806.697	2	22903.349	11115.396
Error	10.302534	5	2.060507	
Total	45817.000	7		
Total (corr.)	213.42857	6		

R-squared = 0.951728

Model Fitting Results

	estimate	stnd.error	ratio
Coefficient 1	1.00374376	.08343039	12.0309
Coefficient 2	.99786493	.15587259	6.4018

Total iterations = 2 Total function evaluations = 7

ANEXO 19

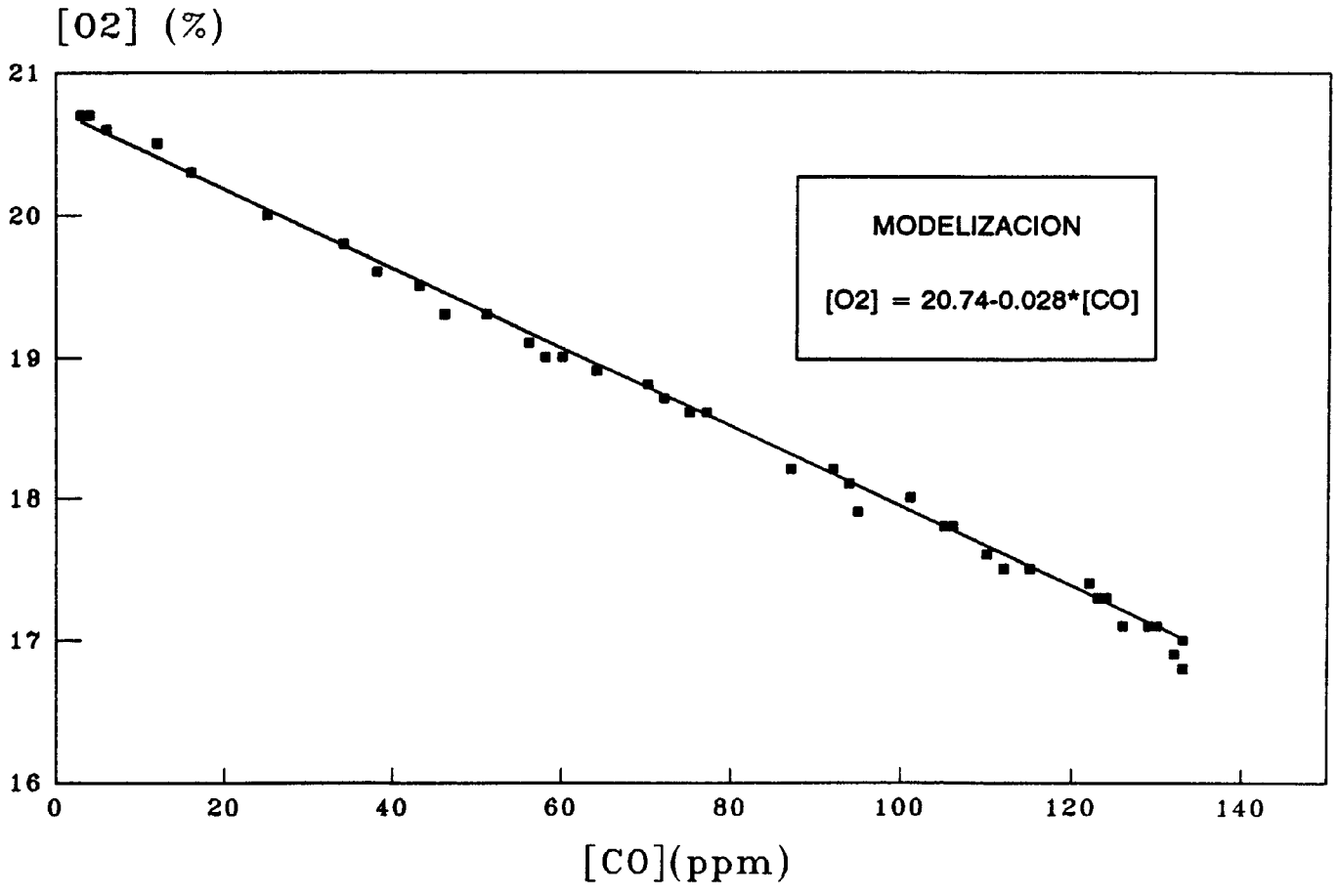
REGRESIONES LINEALES EN LA PARADA DE VENTILACION 1 DEL NIVEL 3152

ANEXO 19.1	**O_2= f(CO)**
ANEXO 19.2	**O_2= f(CO_2)**
ANEXO 19.3	**CO= f(CO_2)**

ANEXO 19.1

$O_2 = f(CO)$

MINA OPORTUNA
NIVEL 3152. [02] = f[CO]



PARADA 1

NIVEL 3152.PARADA 1 ANALISIS DE LA REGRESION - MODELO LINEAL Y = a+bX

VARIABLE DEPENDIENTE : O2 (%) VARIABLE INDEPENDIENTE : CO (ppm)

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	20.7465	0.0246898	840.286	.00000
Slope	-0.0284586	2.79859E-4	-101.689	.00000

Analysis of Variance

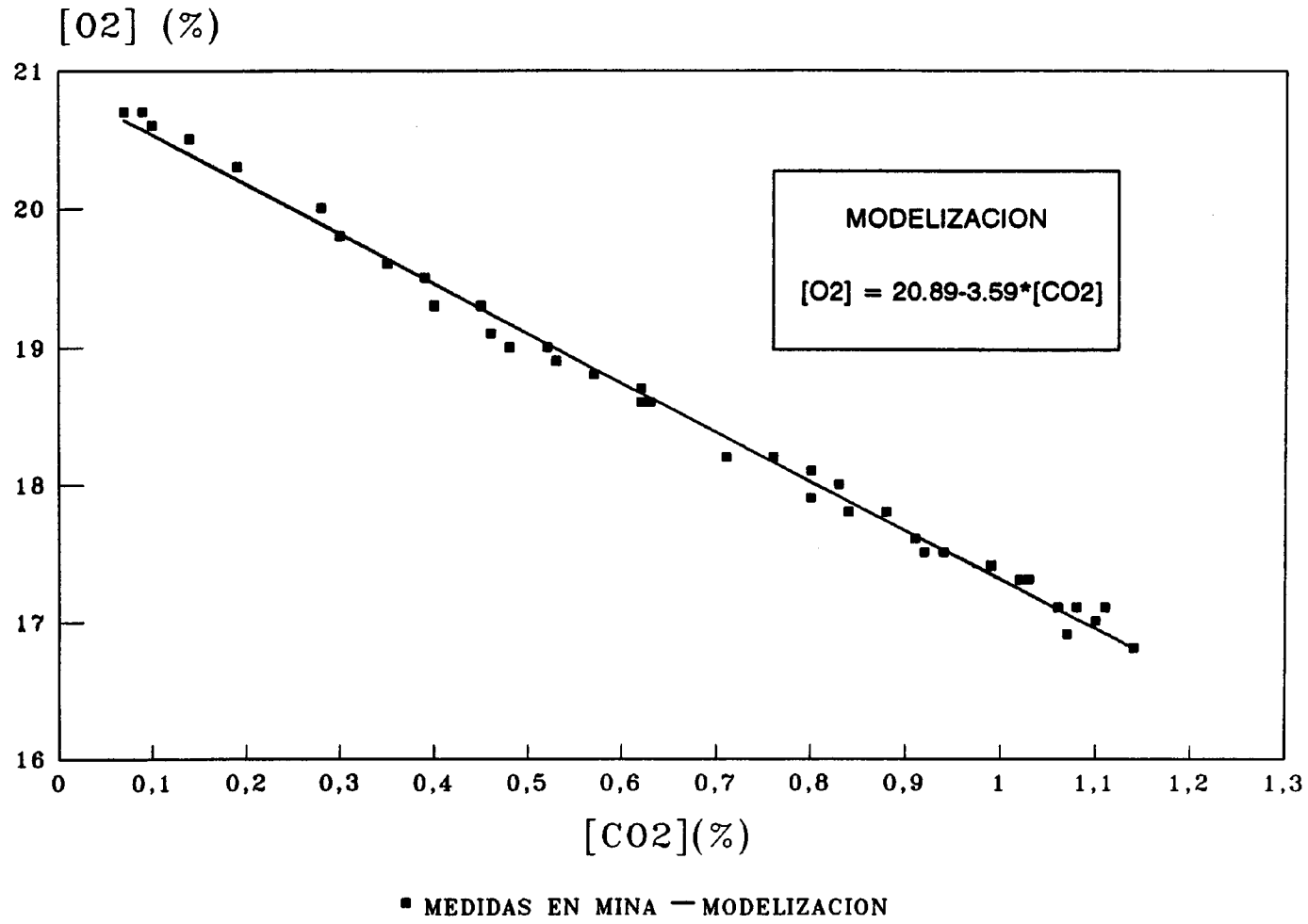
Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	52.151	1	52.151	10340.70	.00000
Error	.186601	37	.005043		
Total (Corr.)	52.337436	38			

Correlation Coefficient = -0.998216 R-squared = 99.64 %
Stnd. Error of Est. = 0.0710159

ANEXO 19.2

$O_2 = f(CO_2)$

MINA OPORTUNA
NIVEL 3152. [02] = f[CO2]



PARADA 1

NIVEL 3152.PARADA 1 ANALISIS DE LA REGRESION - MODELO LINEAL Y = a+bX

VARIABLE DEPENDIENTE : O2 (%) VARIABLE INDEPENDIENTE : CO2 (%)

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	20.8943	0.0337777	618.584	.00000
Slope	-3.59222	0.0459229	-78.2229	.00000

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	52.0229	1	52.0229	6118.820	.00000
Error	.314578	37	.008502		
Total (Corr.)	52.337436	38			

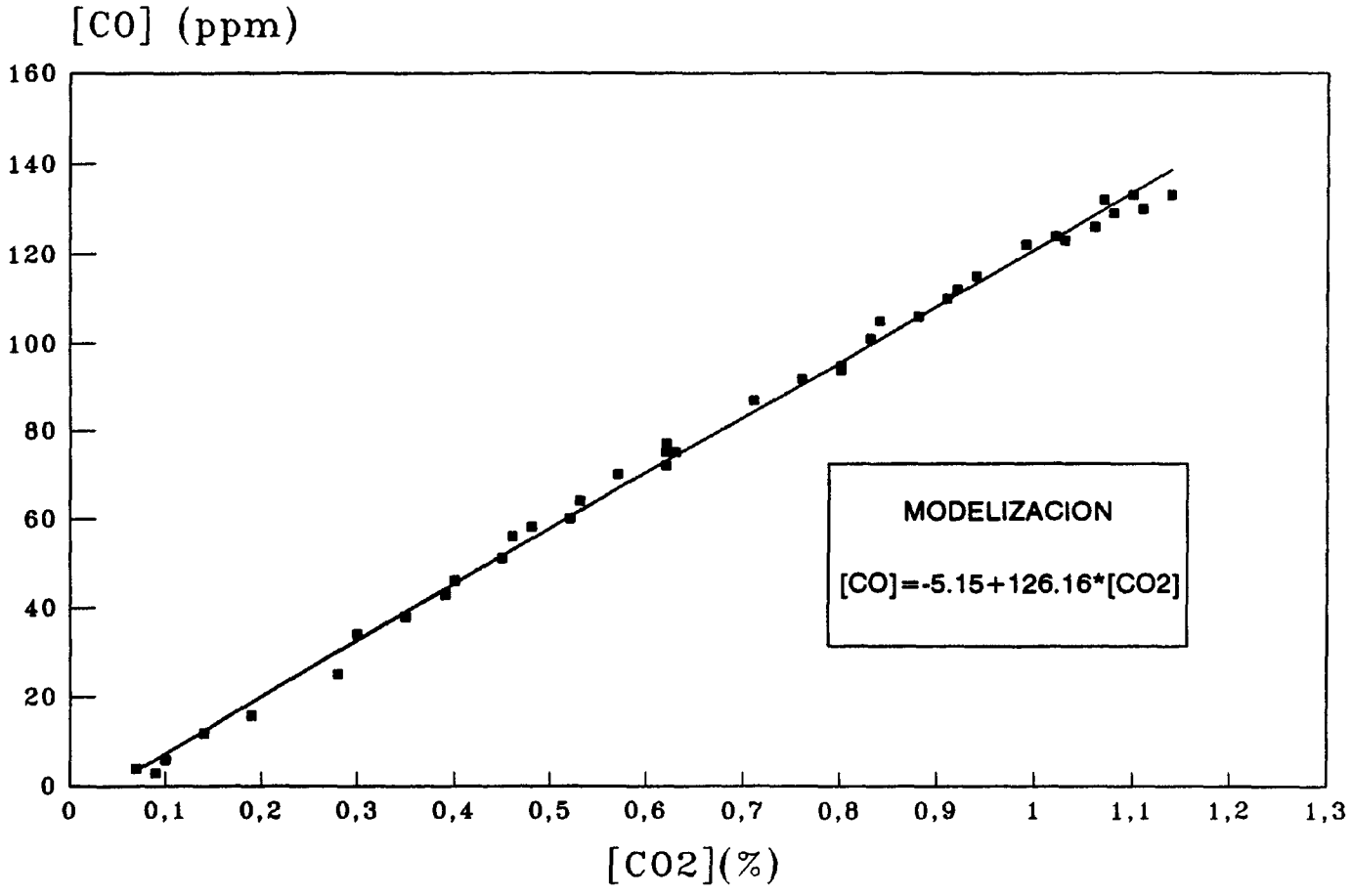
Correlation Coefficient = -0.99699 R-squared = 99.40 %
Stnd. Error of Est. = 0.0922069

ANEXO 19.3

$CO = f(CO_2)$

MINA OPORTUNA

NIVEL 3152. [CO] = f[CO2]



PARADA 1

NIVEL 3152.PARADA 1 ANALISIS DE LA REGRESION - MODELO LINEAL Y = a+bX

VARIABLE DEPENDIENTE : CO (ppm) VARIABLE INDEPENDIENTE : CO2 (%)

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	-5.15471	0.895829	-5.75413	.00000
Slope	126.164	1.21794	103.588	.00000

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	64171.040	1	64171.040	10730.58	.00000
Error	221.26756	37	5.98020		
Total (Corr.)	64392.308	38			

Correlation Coefficient = 0.99828 R-squared = 99.66 %
Stnd. Error of Est. = 2.44545

ANEXO 20

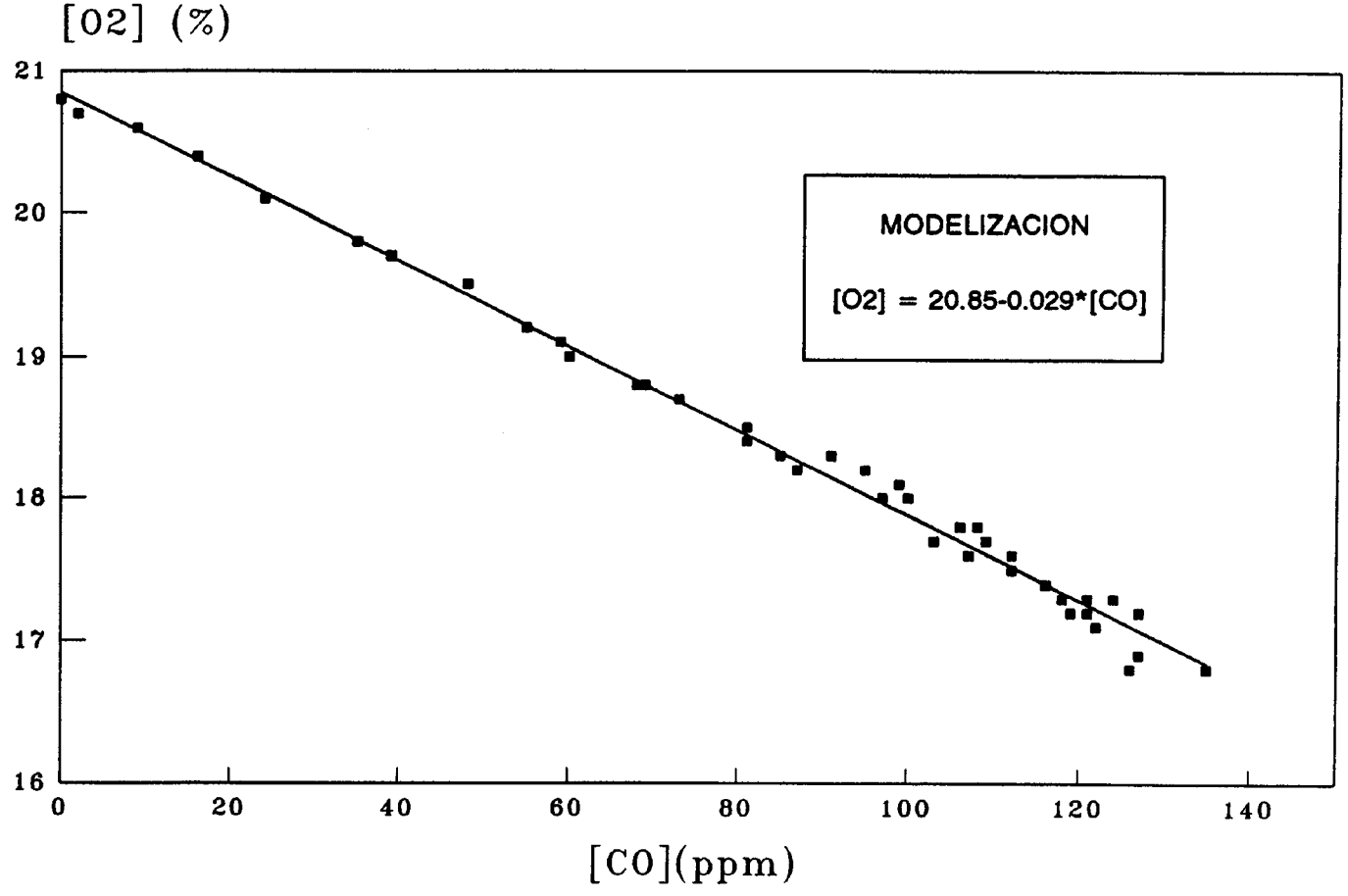
REGRESIONES LINEALES EN LA PARADA DE VENTILACION 2 DEL NIVEL 3152

ANEXO 20.1	**O_2= f(CO)**
ANEXO 20.2	**O_2= f(CO_2)**
ANEXO 20.3	**CO= f(CO_2)**

ANEXO 20.1

$O_2 = f(CO)$

MINA OPORTUNA
NIVEL 3152. [02] = f[CO]



PARADA 2

NIVEL 3152.PARADA 2 ANALISIS DE LA REGRESION - MODELO LINEAL Y = a+bX

VARIABLE DEPENDIENTE : O2 (%) VARIABLE INDEPENDIENTE : CO (ppm)

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	20.8515	0.0385358	541.094	.00000
Slope	-0.0297092	4.10999E-4	-72.2853	.00000

Analysis of Variance

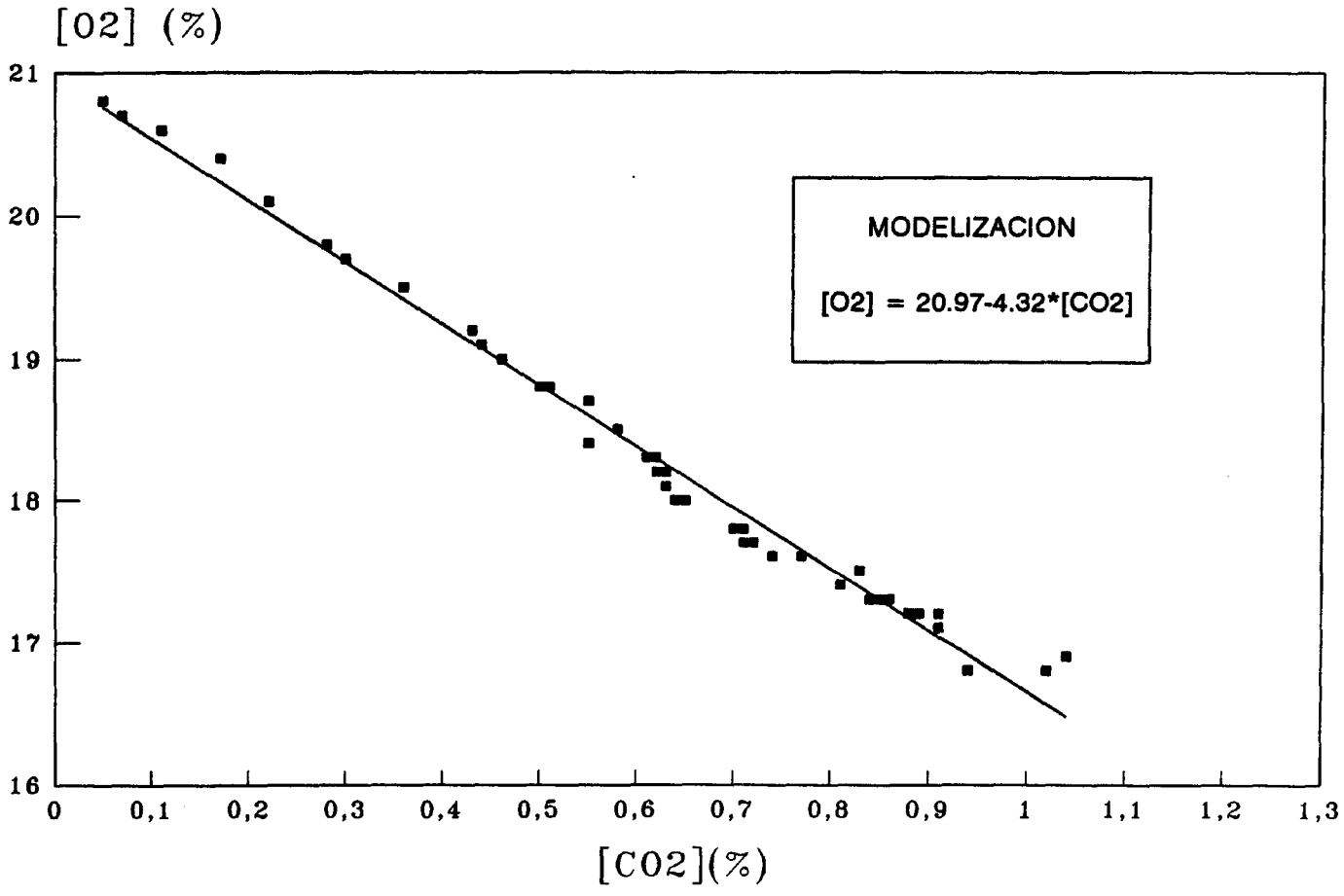
Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	52.4783	1	52.4783	5225.161	.00000
Error	.401735	40	.010043		
Total (Corr.)	52.880000	41			

Correlation Coefficient = -0.996194 R-squared = 99.24 %
Stnd. Error of Est. = 0.100217

ANEXO 20.2

$O_2 = f(CO_2)$

MINA OPORTUNA
NIVEL 3152. [02] = f[CO2]



PARADA 2

NIVEL 3152.PARADA 2 ANALISIS DE LA REGRESION - MODELO LINEAL Y = a+bX

VARIABLE DEPENDIENTE : O2 (%) VARIABLE INDEPENDIENTE : CO2 (%)

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	20.9743	0.0515072	407.211	.00000
Slope	-4.31998	0.0767958	-56.2528	.00000

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	52.2199	1	52.2199	3164.379	.00000
Error	.660097	40	.016502		
Total (Corr.)	52.880000	41			

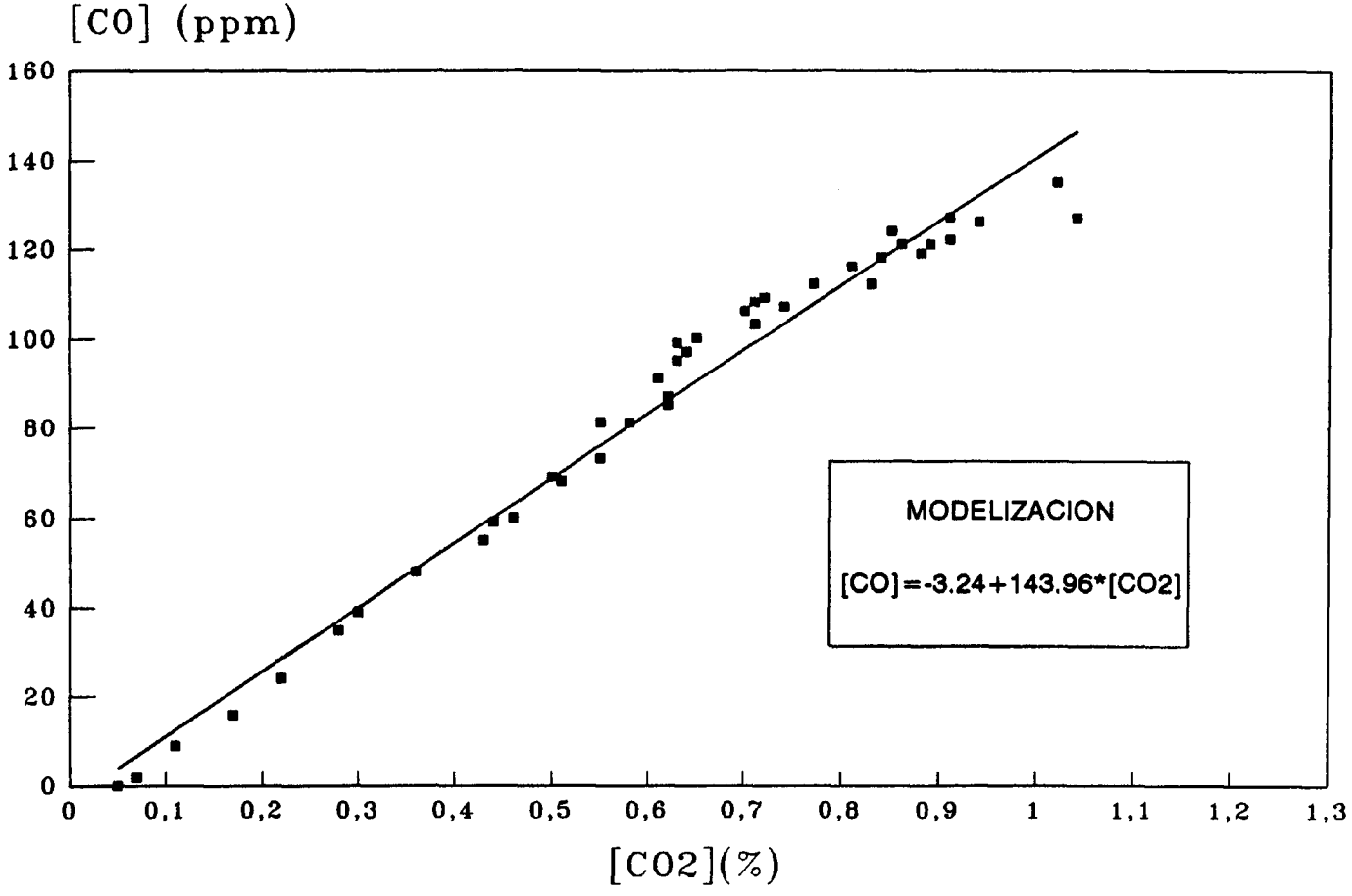
Correlation Coefficient = -0.993739 R-squared = 98.75 %
Stnd. Error of Est. = 0.128462

ANEXO 20.3

$CO = f(CO_2)$

MINA OPORTUNA

NIVEL 3152. [CO] = f[CO2]



PARADA 2

NIVEL 3152.PARADA 2 ANALISIS DE LA REGRESION - MODELO LINEAL Y = a+bX

VARIABLE DEPENDIENTE : CO (ppm) VARIABLE INDEPENDIENTE : CO2 (%)

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	-3.24198	2.42209	-1.33851	.18829
Slope	143.968	3.61126	39.8663	.00000

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	57996.746	1	57996.746	1589.32	.00000
Error	1459.6585	40	36.4915		
Total (Corr.)	59456.405	41			

Correlation Coefficient = 0.987649 R-squared = 97.54 %
Stnd. Error of Est. = 6.04082

ANEXO 21

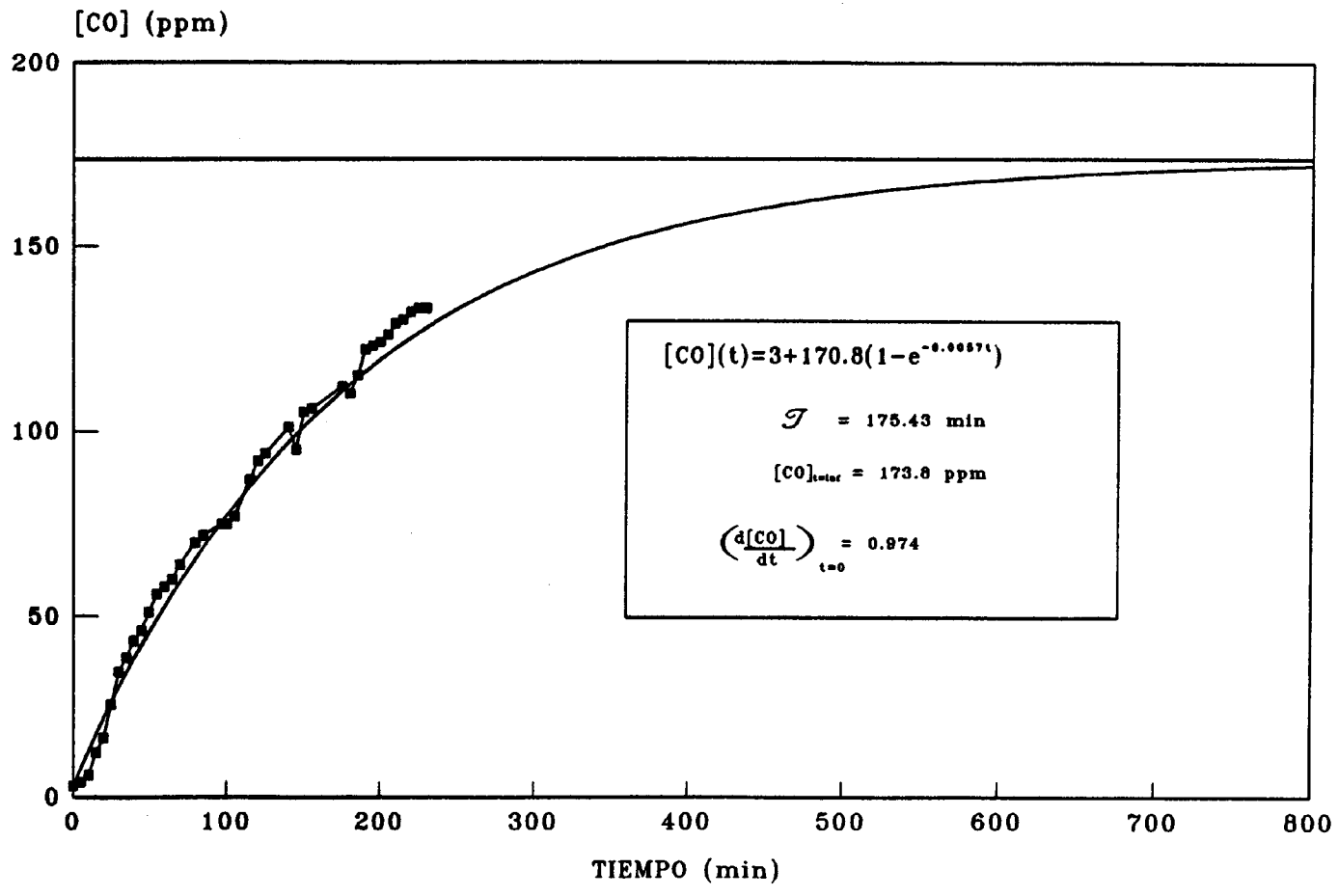
AJUSTES SOBRE SISTEMAS DE 1ER ORDEN DE LOS PARAMETROS MEDIDOS EN LA PARADA DE VENTILACION 1 EN EL NIVEL 3152. FUNCIONES DERIVADAS

ANEXO 21.1	**$CO = f(t)$**
ANEXO 21.2	**$O_2 = f(t)$**
ANEXO 21.3	**$CO_2 = f(t)$**
ANEXO 21.4	**$T_s = f(t)$**
ANEXO 21.5	**$T_h = f(t)$**
ANEXO 21.6	**$T_e = f(t)$**
ANEXO 21.7	**$H_r = f(t)$**
ANEXO 21.8	**$I_G = f(t)$**

ANEXO 21.1

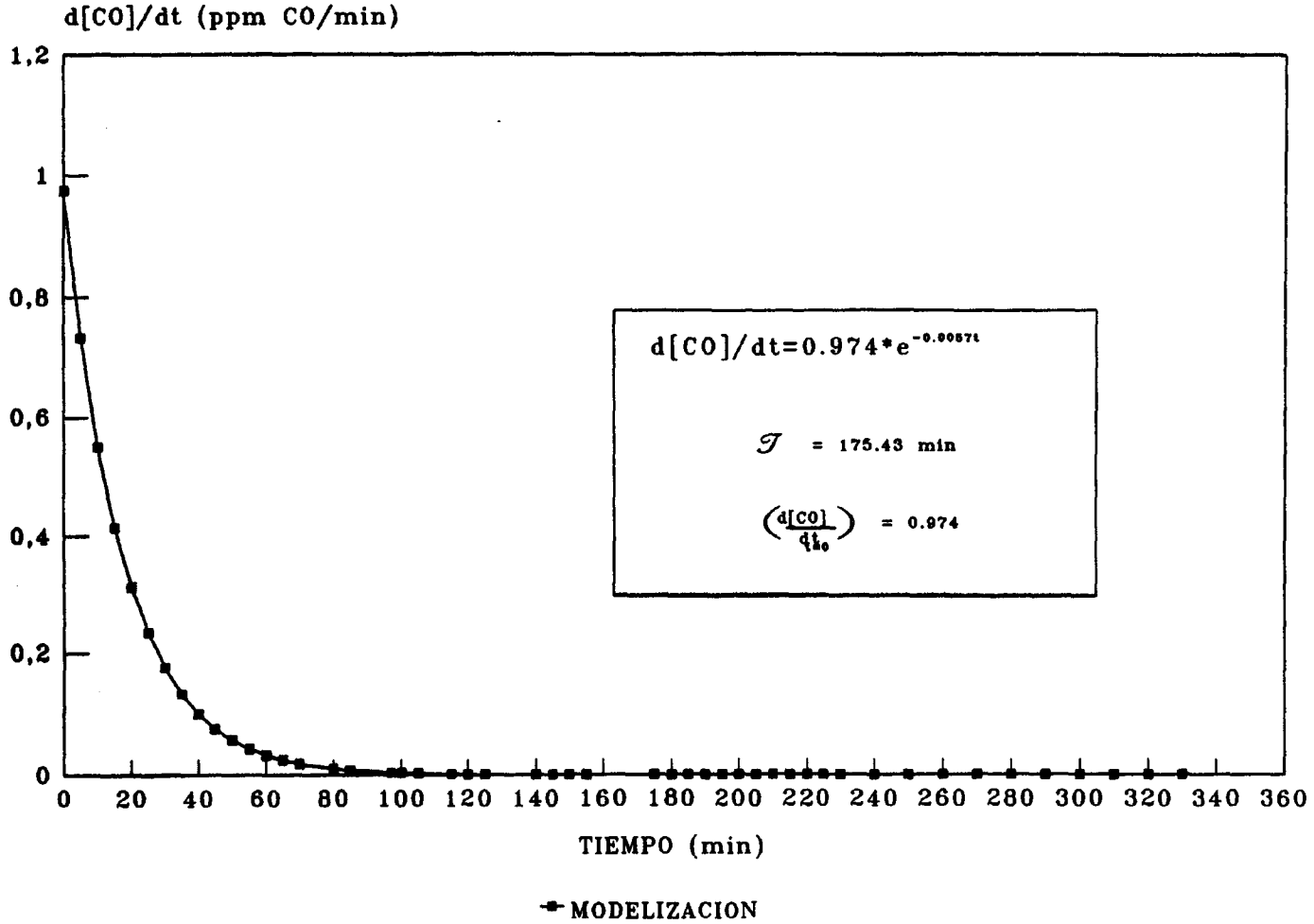
CO= f(t)

MINA OPORTUNA
EVOLUCION DE [CO]



PARADA 1

MINA OPORTUNA
VELOCIDAD DE GENERACION DE [CO]



PARADA 1

Nonlinear Regression

Dep. variable: FELPUD01.CO_Min_

Parameter vector: .5 .5

Function: 3+PARM[1]*170.8*(1-EXP -.0057*PARM[2]*FELPUD01.T__min__)

Maximum iterations: 25
Maximum function calls: 200
Stopping cond. on res. ss: 1E-4
Stopping cond. on estimates: 1E-3

Initial Marquardt parameter: 0.01
Initial scaling factor: 20
Max. value of Marquardt parm.: 120

Analysis of Variance for the Full Regression

source	sum of squares	df	mean square	ratio
Model	303073.54	2	151536.77	11917.75
Error	470.46305	37	12.71522	
Total	303544.00	39		
Total (corr.)	64392.308	38		

R-squared = 0.992694

Model Fitting Results

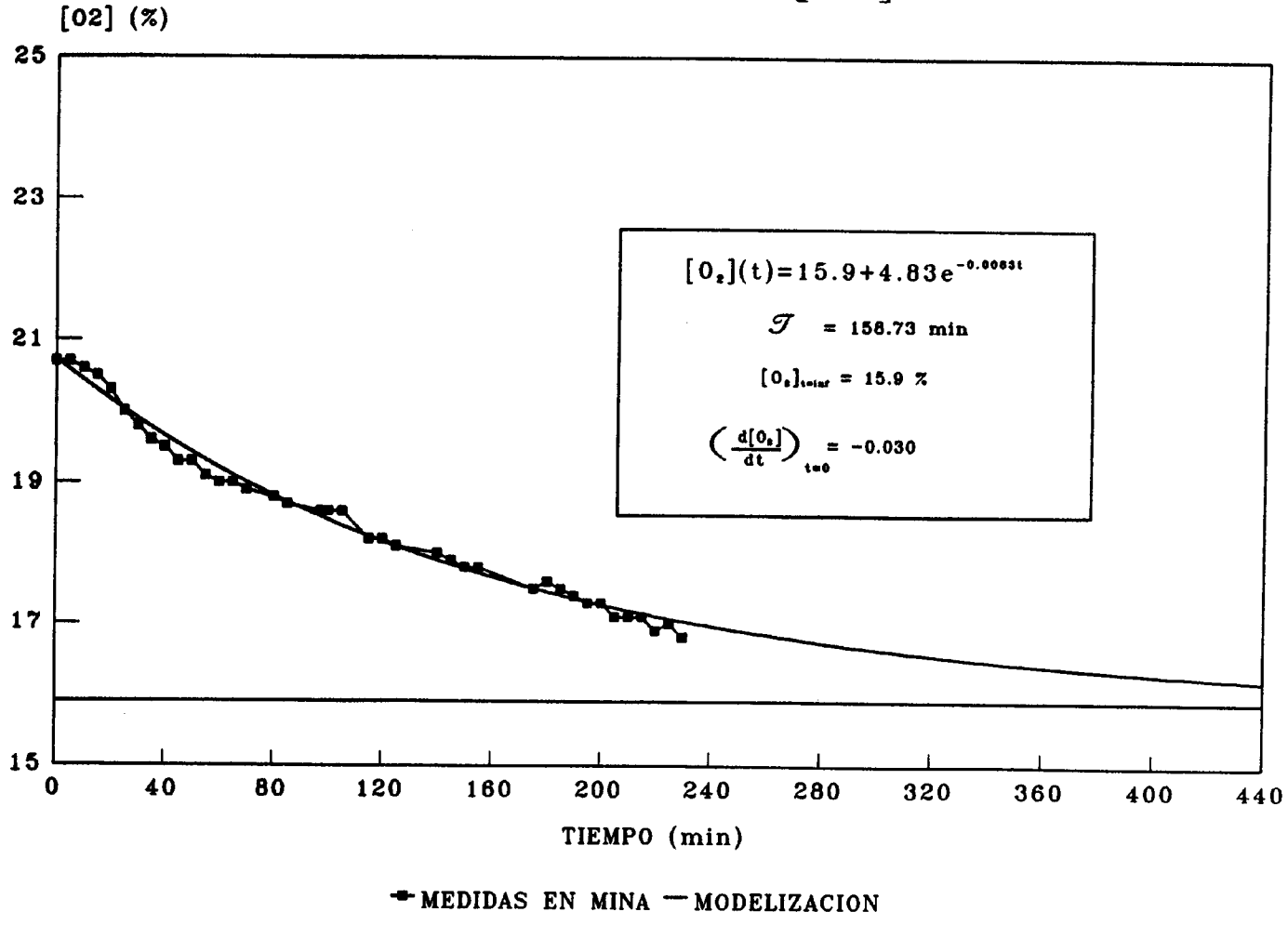
	estimate	stnd.error	ratio
Coefficient 1	1.03692790	.03947273	26.2695
Coefficient 2	.99835749	.06231793	16.0204

Total iterations = 5 Total function evaluations = 16

ANEXO 21.2

$O_2 = f(t)$

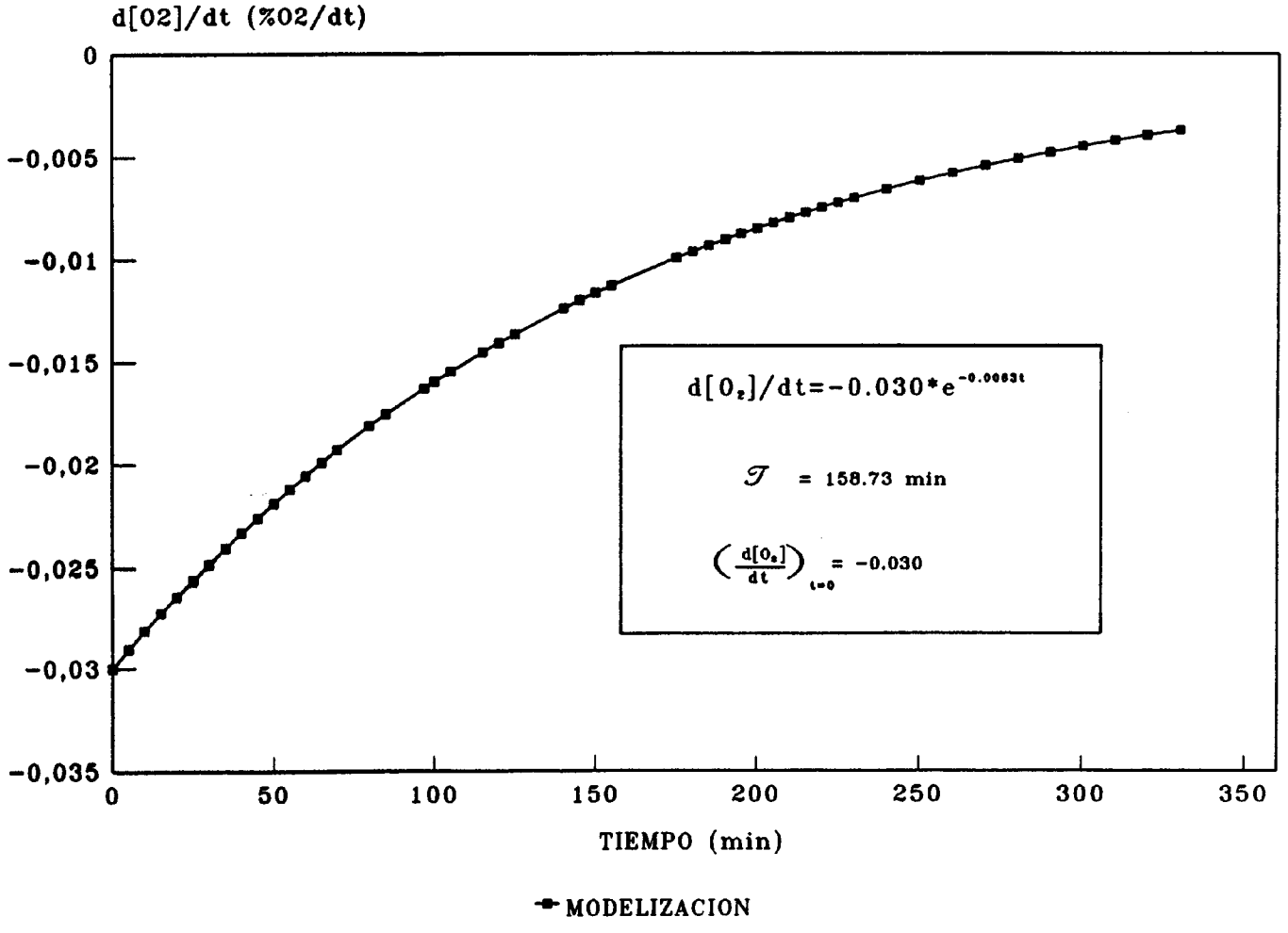
MINA OPORTUNA
EVOLUCION DE [02]



PARADA 1

MINA OPORTUNA

VELOCIDAD DE CONSUMO DE [O2]



PARADA 1

Nonlinear Regression

Dep. variable: FELPUDO1.O2_Mx_

Parameter vector: 1 1

Function: 15.9+PARM[1]*4.828*EXP -0.0063*PARM[2]*FELPUDO1.T__min__

Maximum iterations: 25
Maximum function calls: 200
Stopping cond. on res. ss: 1E-4
Stopping cond. on estimates: 1E-3

Initial Marquardt parameter: 0.01
Initial scaling factor: 20
Max. value of Marquardt parm.: 120

Model Fitting Results

	estimate	stnd.error	ratio
Coefficient 1	1.00005122	.01029196	97.1682
Coefficient 2	1.01247382	.02075267	48.7876

Total iterations = 2 Total function evaluations = 7

Analysis of Variance for the Full Regression

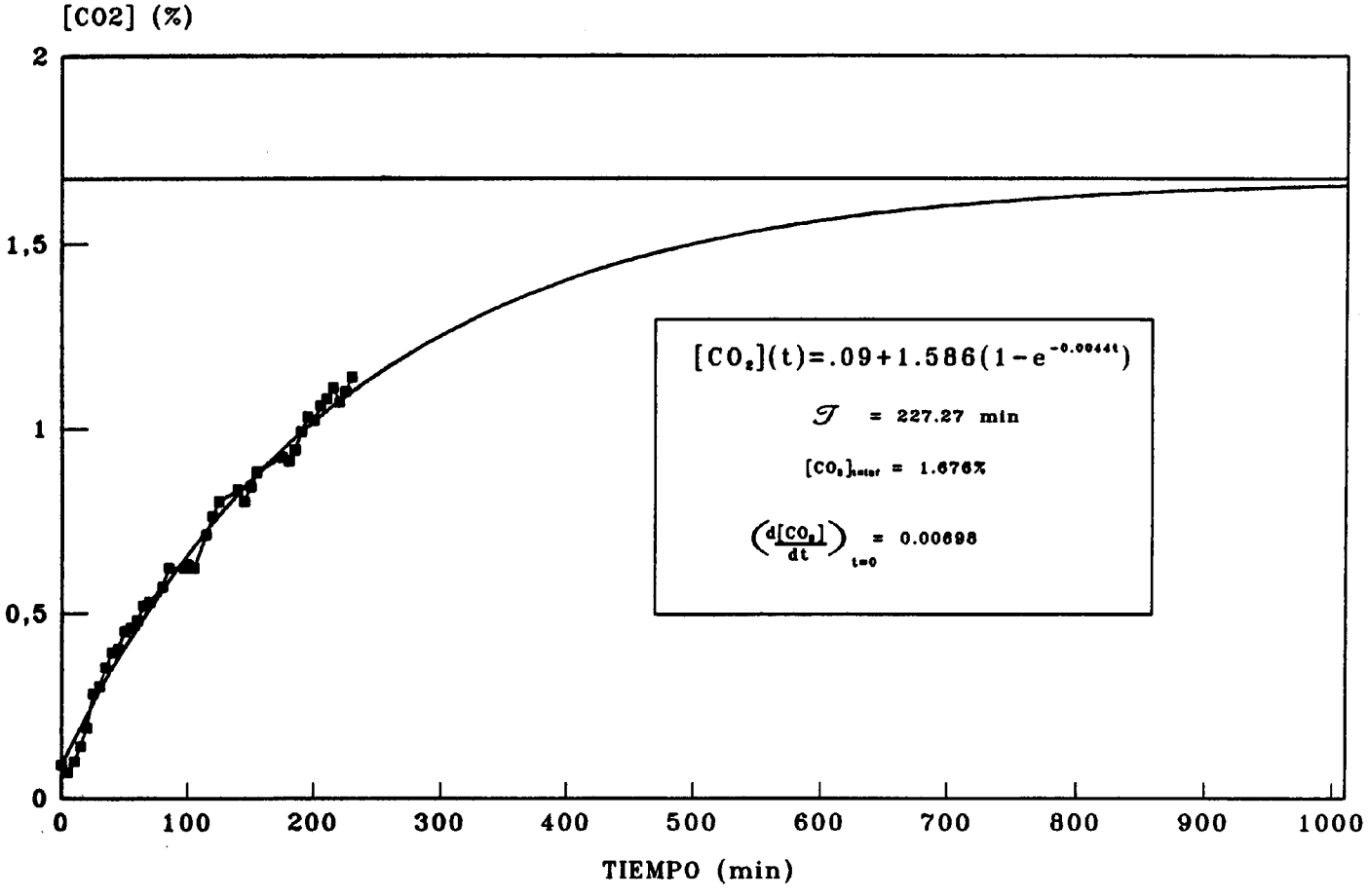
source	sum of squares	df	mean square	ratio
Model	13425.407	2	6712.703	99999.000
Error	.593019	37	.016028	
Total	13426.000	39		
Total (corr.)	52.337436	38		

R-squared = 0.988669

ANEXO 21.3

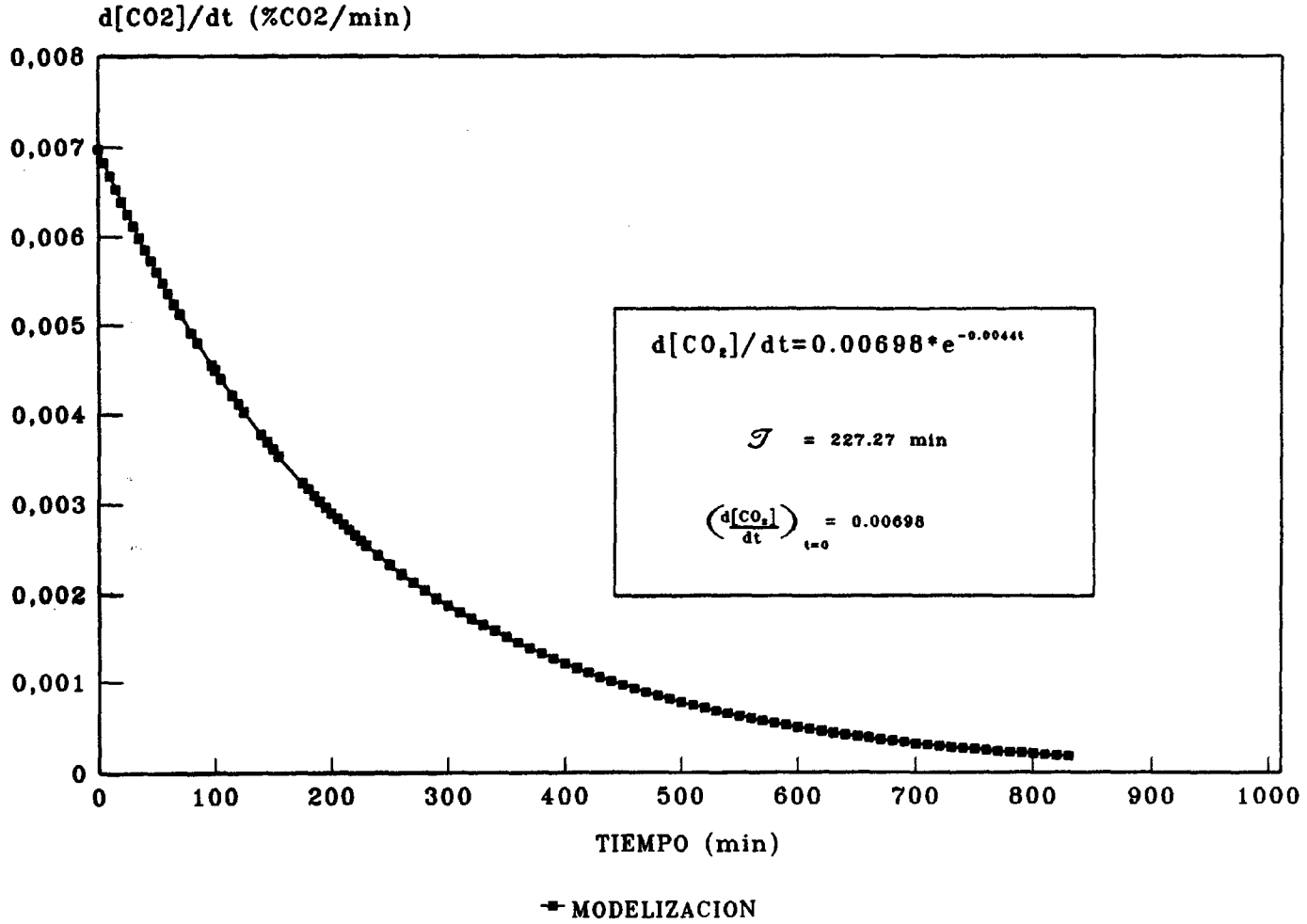
$CO_2 = f(t)$

MINA OPORTUNA
EVOLUCION DE [CO2]



PARADA 1

MINA OPORTUNA
VELOCIDAD DE GENERACION DE [CO2]



PARADA 1

Nonlinear Regression

Dep. variable: FELPUDO1.CO2_Drag_

Parameter vector: .5 .5

Function: 0.09+PARM[1]*1.586*(1-EXP -.0044*PARM[2]*FELPUDO1.T__min__)

Maximum iterations: 25
Maximum function calls: 200
Stopping cond. on res. ss: 1E-4
Stopping cond. on estimates: 1E-3

Initial Marquardt parameter: 0.01
Initial scaling factor: 20
Max. value of Marquardt parm.: 120

Analysis of Variance for the Full Regression

source	sum of squares	df	mean square	ratio
Model	21.060	2	10.530	10018.563
Error	.038889	37	.001051	
Total	21.099200	39		
Total (corr.)	4.031508	38		

R-squared = 0.990354

Model Fitting Results

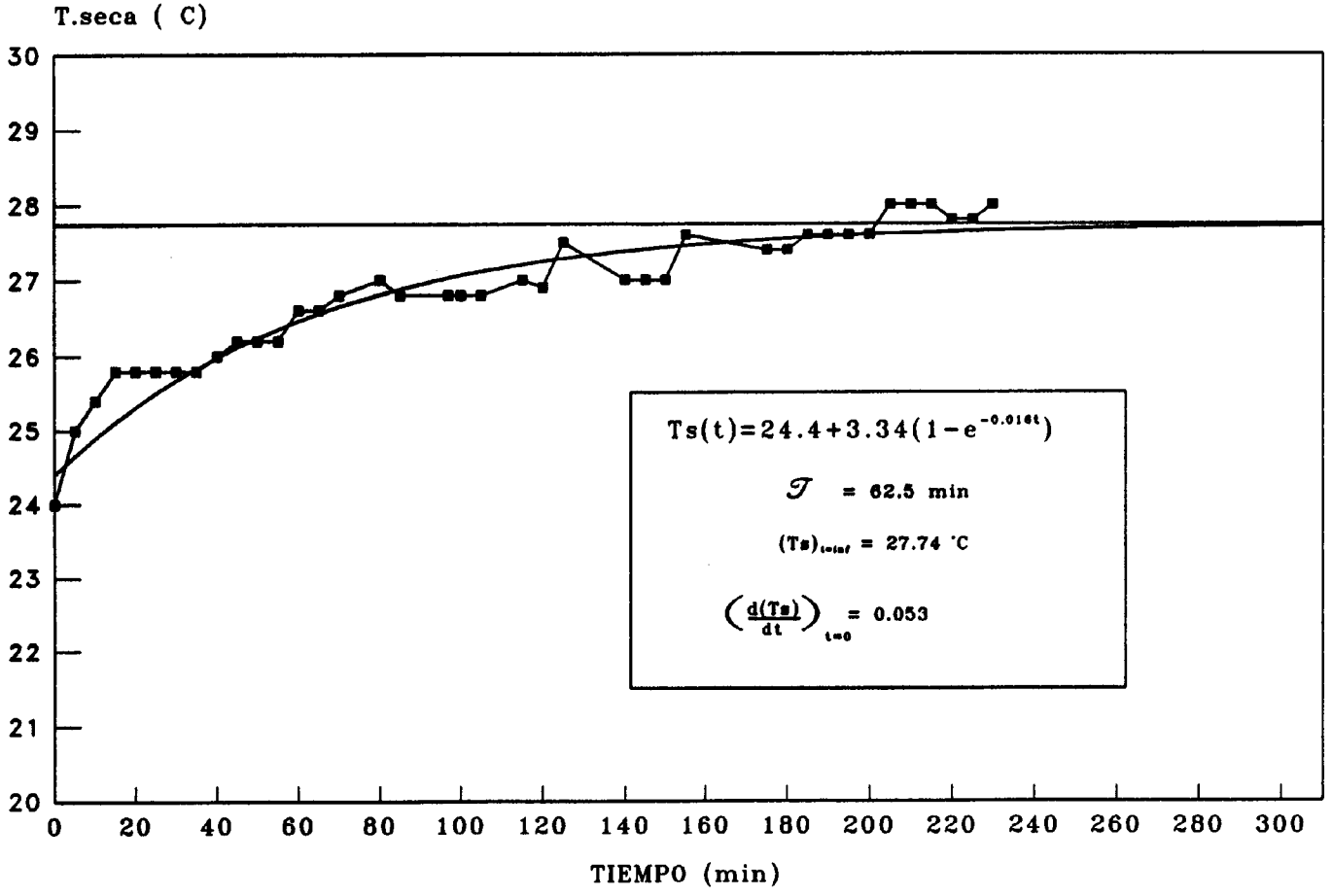
	estimate	stnd.error	ratio
Coefficient 1	1.00251009	.06121880	16.3759
Coefficient 2	1.00838789	.09109622	11.0695

Total iterations = 5 Total function evaluations = 16

ANEXO 21.4

$T_s = f(t)$

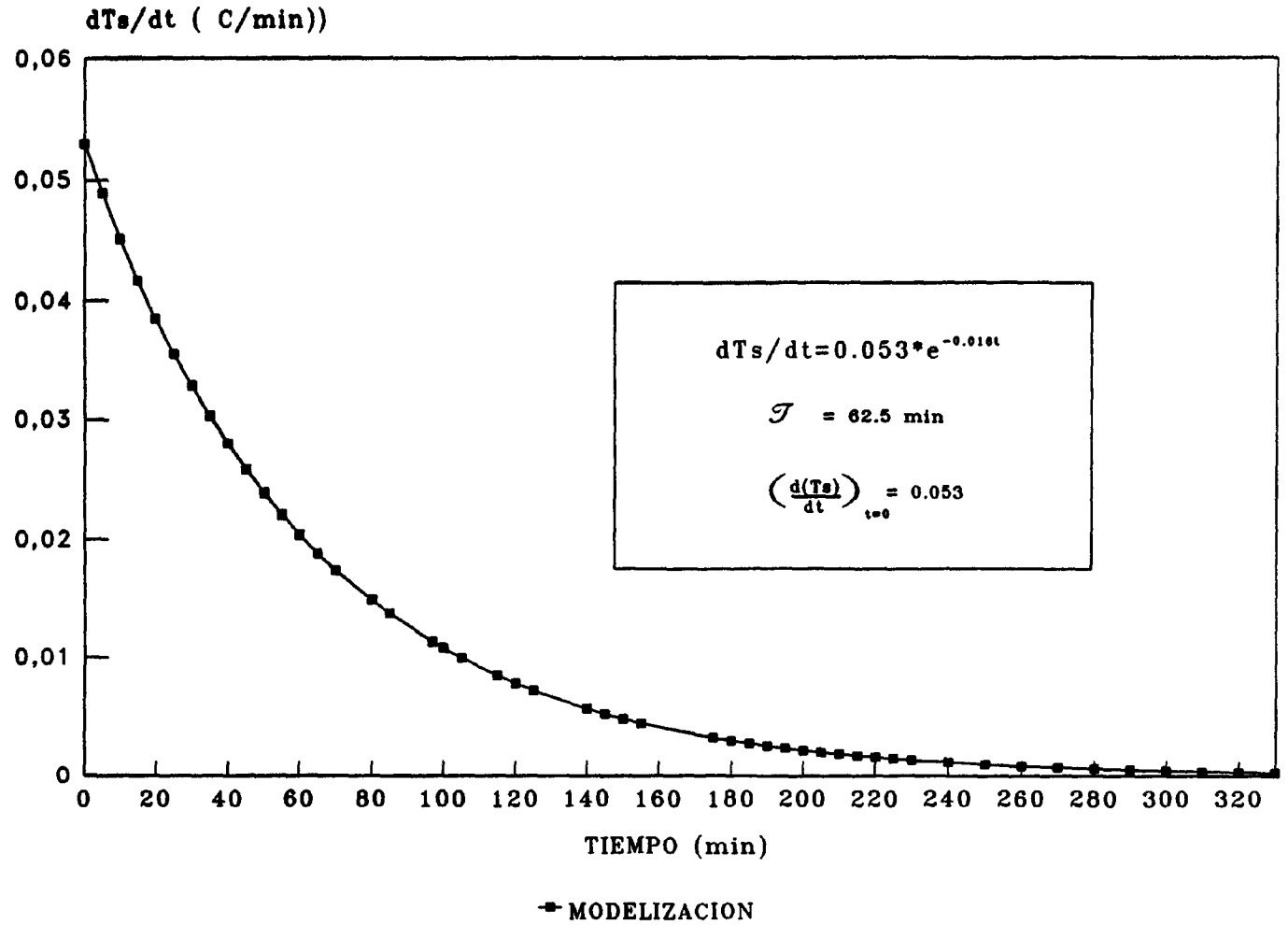
MINA OPORTUNA
EVOLUCION DE LA TEMPERATURA SECA



PARADA 1

MINA OPORTUNA

VELOCIDAD DE EVOLUCION DE LA TEMPERATURA SECA



PARADA 1

Nonlinear Regression

Dep. variable: FELPUDO1.Ts_Psi__

Parameter vector: 1 1

Function: 24.4+PARM[1]*3.34*(1-EXP -0.016*PARM[2]*FELPUDO1.T__min__)

Maximum iterations: 25
Maximum function calls: 200
Stopping cond. on res. ss: 1E-4
Stopping cond. on estimates: 1E-3

Initial Marquardt parameter: 0.01
Initial scaling factor: 20
Max. value of Marquardt parm.: 120

Model Fitting Results

	estimate	stnd.error	ratio
Coefficient 1	1.00171966	.03237953	30.9368
Coefficient 2	1.00925395	.09941032	10.1524

Total iterations = 2 Total function evaluations = 7

Analysis of Variance for the Full Regression

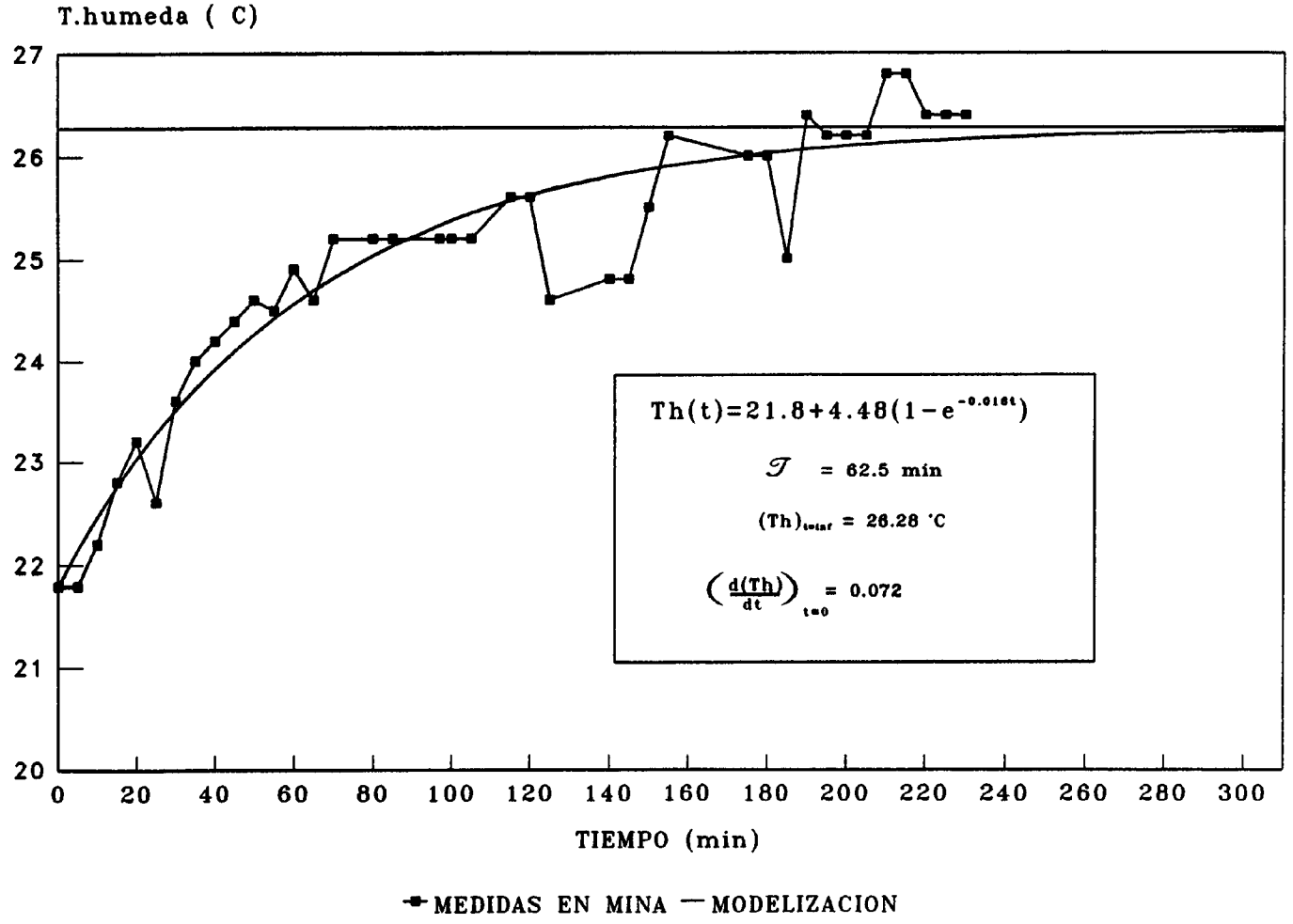
source	sum of squares	df	mean square	ratio
Model	28029.798	2	14014.899	99999.000
Error	3.062063	37	.082758	
Total	28032.860	39		
Total (corr.)	32.218974	38		

R-squared = 0.904961

ANEXO 21.5

$T_h = f(t)$

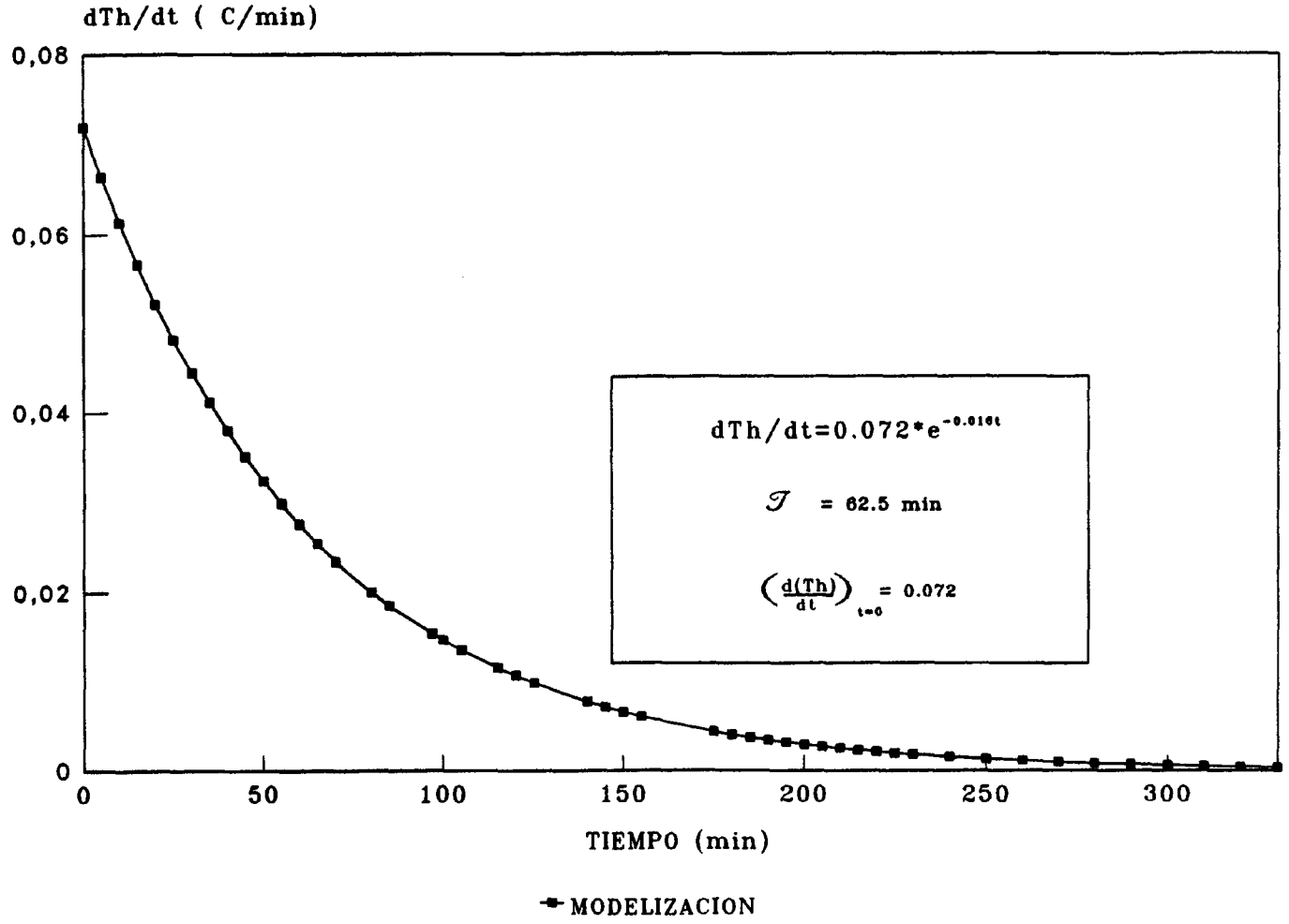
MINA OPORTUNA
EVOLUCION DE LA TEMPERATURA HUMEDA



PARADA 1

MINA OPORTUNA

VELOCIDAD DE EVOLUCION DE LA TEMPERATURA HUMEDA



PARADA 1

Nonlinear Regression

Dep. variable: FELPUDO1.Th_Psi__

Parameter vector: .5 .5

Function: 21.8+PARM[1]*4.48*(1-EXP -.016*PARM[2]*FELPUDO1.T__min__)

Maximum iterations: 25
Maximum function calls: 200
Stopping cond. on res. ss: 1E-4
Stopping cond. on estimates: 1E-3

Initial Marquardt parameter: 0.01
Initial scaling factor: 20
Max. value of Marquardt parm.: 120

Analysis of Variance for the Full Regression

source	sum of squares	df	mean square	ratio
Model	24303.009	2	12151.505	62266.678
Error	7.220647	37	.195153	
Total	24310.230	39		
Total (corr.)	70.043077	38		

R-squared = 0.896911

Model Fitting Results

	estimate	stnd.error	ratio
Coefficient 1	.99893433	.03837367	26.0318
Coefficient 2	.98055798	.11234742	8.7279

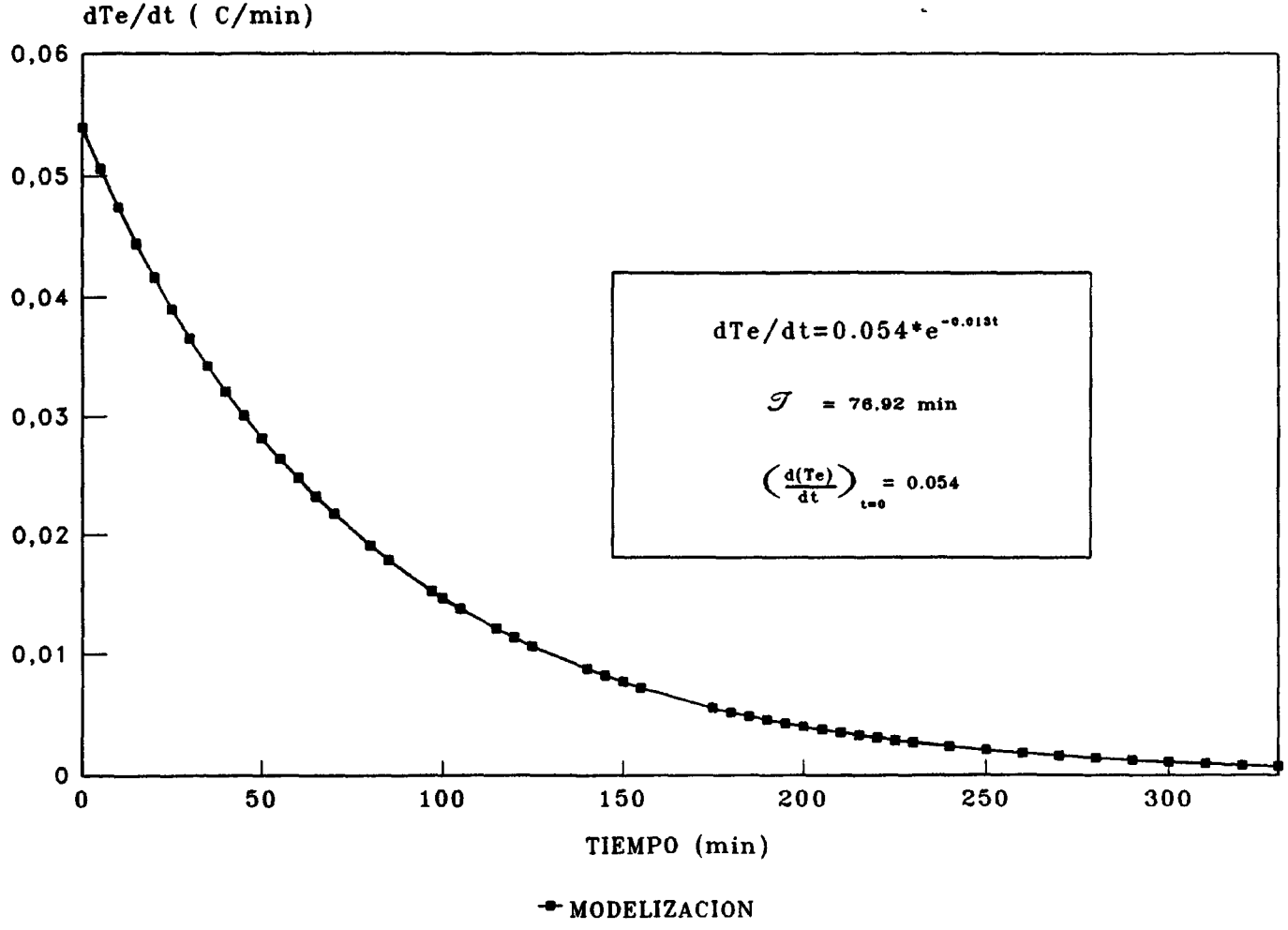
Total iterations = 4 Total function evaluations = 13

ANEXO 21.6

$T_e = f(t)$

MINA OPORTUNA

VELOCIDAD DE EVOLUCION DE LA TEMPERATURA EQUIVALENTE



PARADA 1

Nonlinear Regression

Dep. variable: FELPUDO1.Tequiv_

Parameter vector: 1 1

Function: 22.4+PARM[1]*4.176*(1-EXP -0.013*PARM[2]*FELPUDO1.T__min__)

Maximum iterations: 25
Maximum function calls: 200
Stopping cond. on res. ss: 1E-4
Stopping cond. on estimates: 1E-3

Initial Marquardt parameter: 0.01
Initial scaling factor: 20
Max. value of Marquardt parm.: 120

Model Fitting Results

	estimate	stnd.error	ratio
Coefficient 1	.99958895	.04811265	20.7760
Coefficient 2	1.00818992	.12933963	7.7949

Total iterations = 2 Total function evaluations = 7

Analysis of Variance for the Full Regression

source	sum of squares	df	mean square	ratio
Model	24662.716	2	12331.358	71506.388
Error	6.380692	37	.172451	
Total	24669.097	39		
Total (corr.)	65.060990	38		

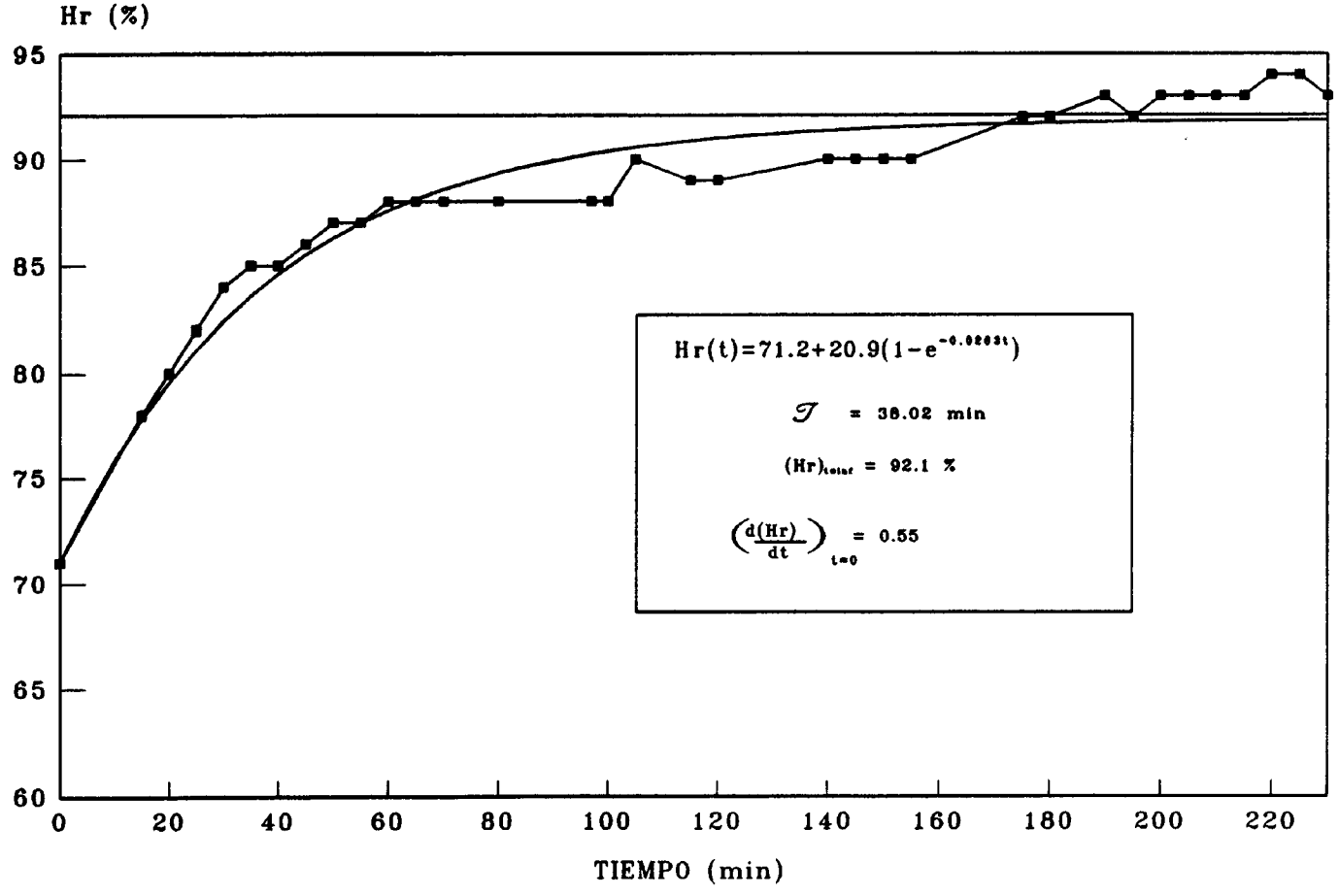
R-squared = 0.901928

ANEXO 21.7

$H_r = f(t)$

MINA OPORTUNA

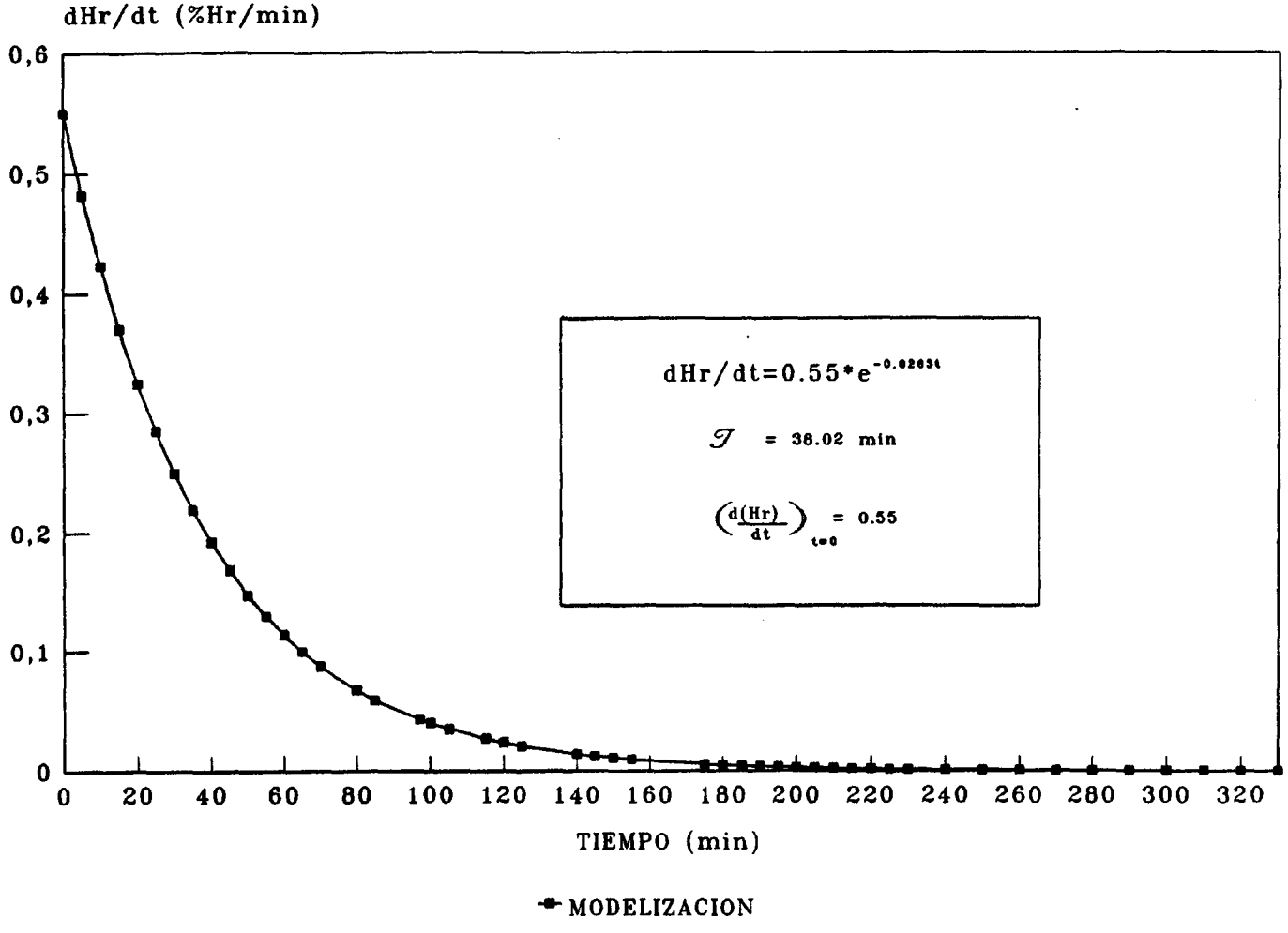
EVOLUCION DE LA HUMEDAD RELATIVA



PARADA 1

MINA OPORTUNA

VELOCIDAD DE EVOLUCION DE LA HUMEDAD RELATIVA



PARADA 1

Nonlinear Regression

Dep. variable: FELPUDO1.H_Sieg__

Parameter vector: .5 .5

Function: 71.2+PARM[1]*20.9*(1-EXP -.0263*PARM[2]*FELPUDO1.T__min__)

Maximum iterations: 25
Maximum function calls: 200
Stopping cond. on res. ss: 1E-4
Stopping cond. on estimates: 1E-3

Initial Marquardt parameter: 0.01
Initial scaling factor: 20
Max. value of Marquardt parm.: 120

Analysis of Variance for the Full Regression

source	sum of squares	df	mean square	ratio
Model	265999.26	2	132999.63	79191.06
Error	53.743288	32	1.679478	
Total	266053.00	34		
Total (corr.)	817.44118	33		

R-squared = 0.934254

Model Fitting Results

	estimate	stnd.error	ratio
Coefficient 1	.99105916	.01660133	59.6976
Coefficient 2	.98974438	.06579668	15.0425

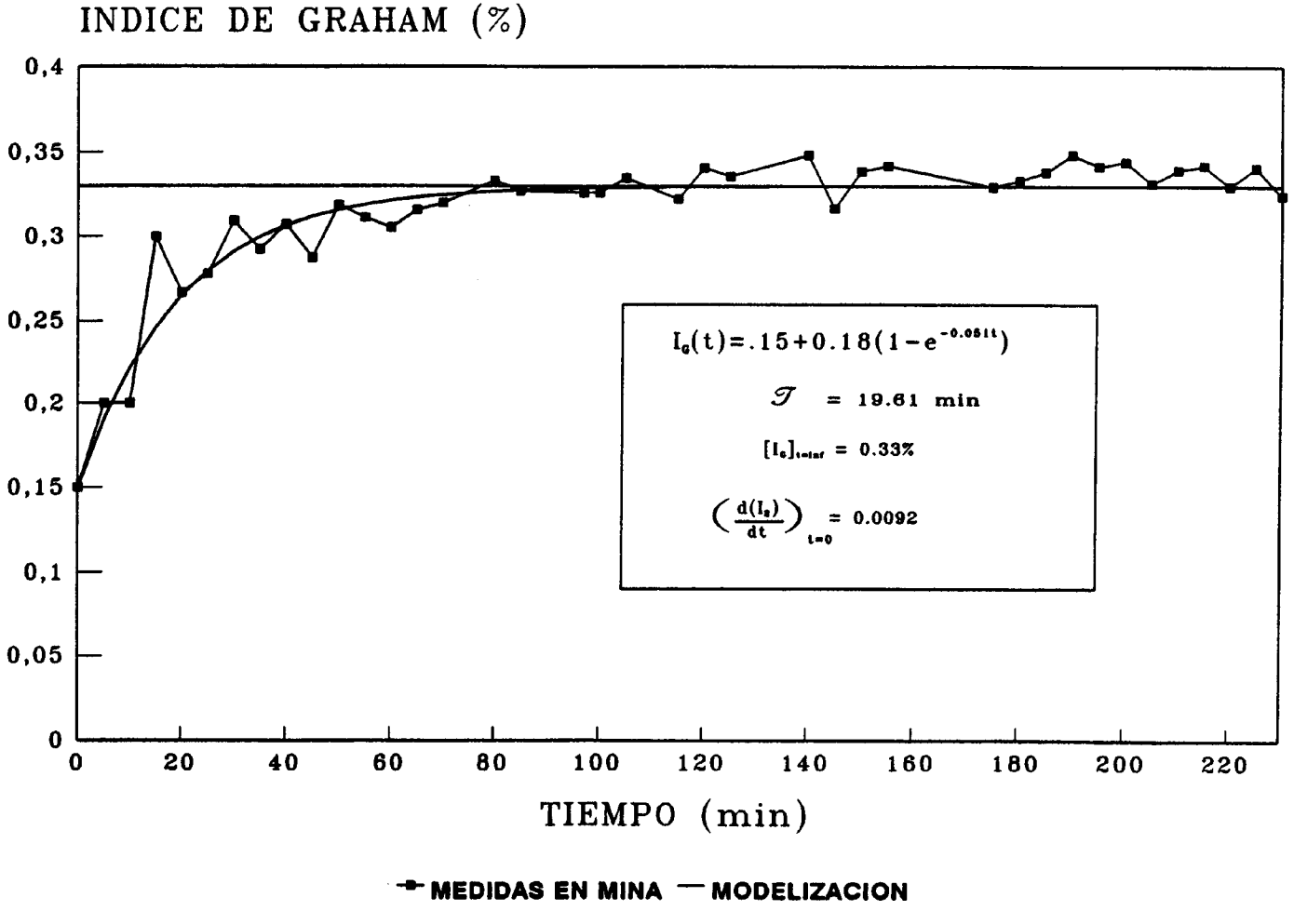
Total iterations = 4 Total function evaluations = 13

ANEXO 21.8

$I_G = f(t)$

MINA OPORTUNA

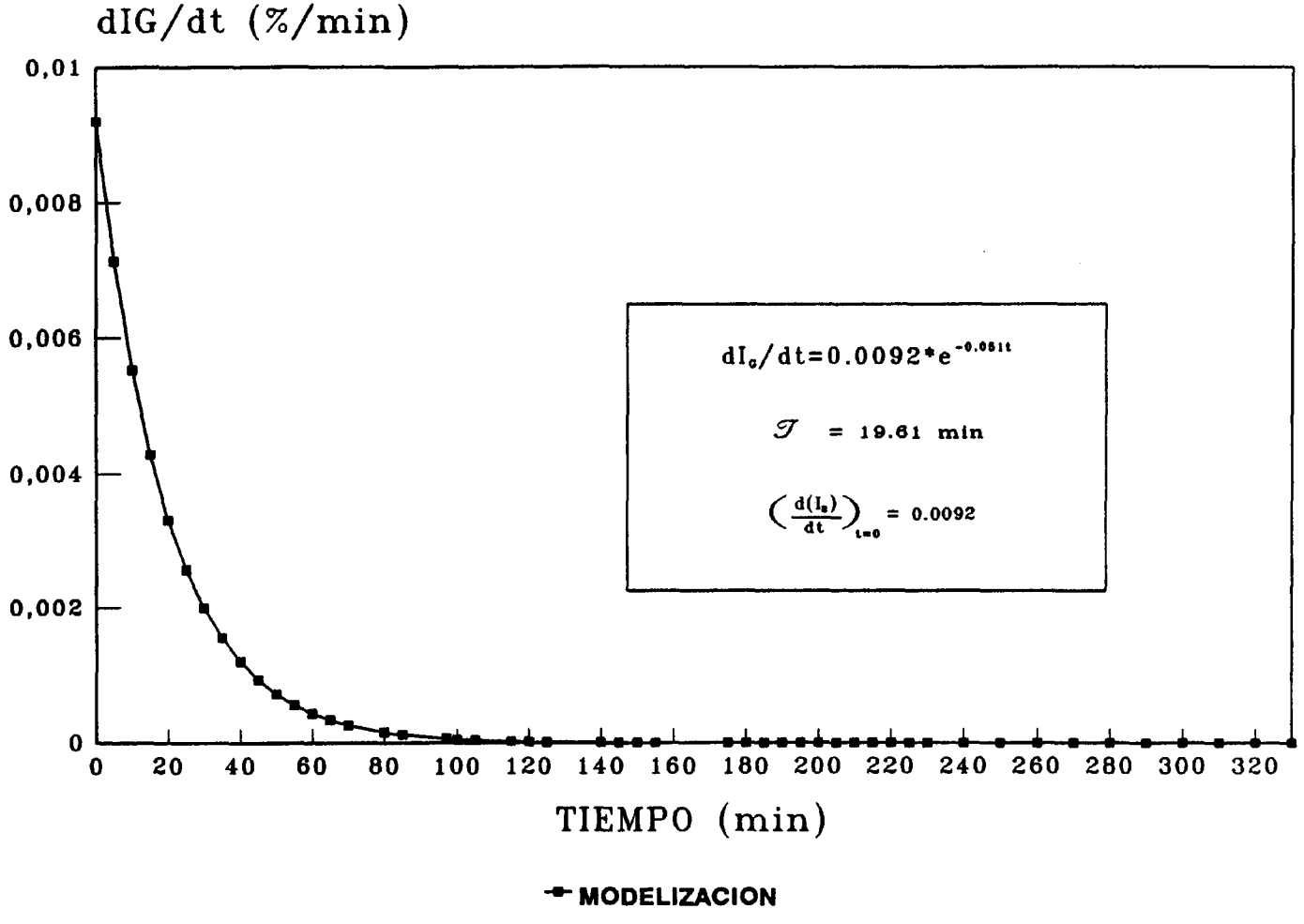
EVOLUCION DEL INDICE DE GRAHAM



PARADA 1

MINA OPORTUNA

VELOCIDAD DE EVOLUCION DEL INDICE DE GRAHAM



PARADA 1

Nonlinear Regression

Dep. variable: F1.CO_min__O2

Parameter vector: 1 1

Function: .15+.18*PARM[1]*(1-EXP -.051*PARM[2]*F1.T__min__)

Maximum iterations: 25
Maximum function calls: 200
Stopping cond. on res. ss: 1E-5
Stopping cond. on estimates: 1E-4

Initial Marquardt parameter: 0.01
Initial scaling factor: 20
Max. value of Marquardt parm.: 120

Analysis of Variance for the Full Regression

source	sum of squares	df	mean square	ratio
Model	3.878	2	1.939	10638.239
Error	.006744	37	.000182	
Total	3.884820	39		
Total (corr.)	.069996	38		

R-squared = 0.903651

Model Fitting Results

	estimate	stnd.error	ratio
Coefficient 1	1.01707454	.01504206	67.6154
Coefficient 2	1.00077789	.08659238	11.5573

Total iterations = 2 Total function evaluations =