

# Curriculum Vitae

## *Reynaldo Daniel Pinto*

Date of birth: January 3<sup>rd</sup>, 1968 in São Paulo city, SP, Brazil

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### **Current Occupation:**

- Assistant Professor at the Department of General Physics (Nonlinear Phenomena Laboratory) of the Institute of Physics (IFUSP)- University of São Paulo (USP) - State of São Paulo (SP) – Brazil.
- Collaborator at the Institute for Nonlinear Science (INLS) - University of California, San Diego, USA (<http://inls.ucsd.edu>).

### **Current Research Interests:**

- Biological Neural Networks;
- Experiments in Neural Dynamics;
- The role of Chaos in Biological Neural Networks;
- Processing and transmission of information in Biological Neural Networks;
- Central Pattern Generators;
- Synaptic Plasticity and Learning;
- Modifying Biological Neural Networks by Inserting Artificial Synapses and Conductances Using Dynamic Clamp Protocol;
- Dynamical Systems and Chaos;
- Topological Characterization of Experimental Attractors;
- Model Neurons and their Electronic Implementation;
- Interaction Between Artificial and Biological Neurons.

### **Educational Background:**

- Post Doctor in Experimental Neuroscience at the Institute for Nonlinear Science, University of California, San Diego, USA from May/1999 to April/2001.
- Ph.D. in Physics in March 1999 from the Institute of Physics - USP - SP - Brazil with the thesis “Complex Behavior in the Dripping Faucet Experiment” under supervision of Prof. José Carlos Sartorelli.
- Physics B. Sc. in 1993 from the Institute of Physics - USP - SP - Brazil.
- Electronics Technician in 1985 from the EPSG Castro Alves - SP - Brazil.

### **Awards:**

- Brazilian Physics Society - “Best Ph.D. Thesis Prize - Honor Mention” (November 2000) for the Ph. D. Thesis “Complex Behavior in a Dripping Faucet experiment”;

### **Fellowships:**

- Fundação de Amparo à Pesquisa do Estado de São Paulo - FAPESP Post Doctoral fellowship at the IFUSP from May 2001;
- Fundação de Amparo à Pesquisa do Estado de São Paulo - FAPESP Post Doctoral fellowship at the INLS from May 1999 to April 2001;
- Fundação de Amparo à Pesquisa do Estado de São Paulo - FAPESP Ph.D. fellowship from March 1997 to February 1999;
- Conselho Nacional de Pesquisa - CNPq fellowship from March 1994 to February 1997.

### **Professional Experience:**

- Teacher - from February 1994 to December 1997 at the Institute of Physics - USP - SP – Brazil, in the following undergrad regular courses:
  - Introduction to Measurements in Physics – FAP 152 (1994 e 1995);
  - Thermodynamics I – FMT 159 (1995, 1996);
  - Modern Physics II – FNC 376 (1996);
  - Mechanics of Rigid Bodies and Flows – FEP 255 (1997);
  - Óptics – FGE 160 (1997).
- Electronics technician (development and maintenance of electronic equipment for Nuclear Physics) - from March 1990 to March 1994 at the Linear Accelerator

Laboratory - Institute of Physics - USP - SP - Brazil;

- Electronic technician (computer maintenance) - from June 1986 to March 1990 at the Electronics Computation Center - USP - SP - Brazil;

### **Supervision of Students:**

- Supervision of the lab work of the undergrad student Greeg Stiesberg with the project: “Implementation of a low dimensional chaotic neuron model in analog circuitry”, at the Institute for Nonlinear Science, UCSD from June/1999 to April/2001.
- Supervision of the undergrad student Fabio Stucchi Vannucchi with the project: “Information Processing in Electronic Model Neurons: The Role of Chaos”, at the LFNL-IFUSP from March 2002.
- Supervision of the undergrad student Gabriela Camargo Campos with the project: “Dynamical Characterization of Electronic Model Neurons Behavior with Lyapunov Exponents” at the LFNL-IFUSP from March 2002.
- Co-supervision of the Ph.D. student Angela Maria dos Santos with the project: “Nonlinear Dynamics and Information Theory Applied to Neural Networks”, at the Universidade Federal do Paraná (UFPR) with Prof. Ricardo Luiz Viana. from March 2002.

### **Skills:**

- computer Hardware;
- computer Operating Systems: DOS, Windows, Windows 95, VMS, UNIX, Linux;
- development of software: Assembler, Pascal, C, and C++ languages;
- development and assembly of digital electronics, data acquisition boards, analog circuits, interfaces between experiments and computers;
- mechanical and electro-electronics assemblies.

### **Development of Scientific Software (free downloadable):**

- DYNACLAMP4: software developed to control up to 4 biological neurons, introducing artificial synapses and conductances in real time. Free downloads from:

<http://fge.if.usp.br/~reynaldo/dynclamp.htm> or  
<http://inls.ucsd.edu/~rpinto/dynclamp.htm>

### **Relevant Publications:**

- 1) M. I. Rabinovich, R. D. Pinto, E. Tumer, G. Stiesberg, R. Huerta, and H. D. I. Abarbanel, The role of dynamical synapses in neural information processing, Submitted to *Network: Computation in Neural Systems* (2001).
- 2) M. I. Rabinovich, R. D. Pinto, and R. Huerta, Informational Neurodynamics: What are we looking for?, Accepted for publication in *J. Stat. Phys* (2001).
- 3) G. R. Stiesberg, R. D. Pinto, A. Szücs, and H. D. I. Abarbanel, Implementation of a low dimensional chaotic neuron model in analog circuitry, Accepted for publication in *Am. J. Phys.* (2001).
- 4) M. I. Rabinovich, R. D. Pinto, and R. Huerta, Some problems of Informational Neurodynamics, Accepted for publication in *Izv. VUZ Raiofiz., RPQAEC*, 44(6) junho (2001).
- 5) R. D. Pinto, R. C. Elson, A. Szücs, M. I. Rabinovich, A. I. Selverston, and H. D. I. Abarbanel, Extended dynamic clamp: controlling up to four neurons using a single desktop computer and interface, *J. Neurosci. Methods*, 108, 39-48 (2001).
- 6) R. D. Pinto, J. C. Sartorelli, and W. M. Gonçalves, Homoclinic tangencies and routes to chaos in a dripping faucet experiment, *Physica A* 291, 244-54 (2000).
- 7) A. I. Selverston, M. I. Rabinovich, H. D. I. Abarbanel, R. C. Elson, A. Szücs, R. D. Pinto, R. Huerta, and P. Varona, Reliable Circuits from Irregular Neurons: A Dynamical Approach to Understanding Central Pattern Generators, *J. Physiol. (Paris)* 94, 357-374 (2000).
- 8) R. D. Pinto, P. Varona, A. R. Volkovskii, A. Szücs, H. D. I. Abarbanel, and M. I. Rabinovich, Synchronous behavior of two coupled electronic neurons, *Phys. Rev. E* **62**, 2644-2656 (2000).
- 9) R. D. Pinto and J. C. Sartorelli, Homoclinic tangency and chaotic attractor disappearance in a dripping faucet, *Phys. Rev. E* **61**, 342-347 (2000).
- 10) A. Tufaile, R. D. Pinto, W. M. Gonçalves, and J. C. Sartorelli, Simulations in a dripping faucet experiment, *Phys. Lett. A* **255**, 58-64 (1999).

- 11) W.M. Gonçalves, R.D. Pinto and J.C. Sartorelli, Symbolic dynamics analysis in the dripping faucet experiment, *Physica D* **134**, 267-274 (1999).
- 12) R. D. Pinto, W. M. Gonçalves, J. C. Sartorelli I. L. Caldas and M. S. Baptista, Interior crises in a dripping faucet experiment, *Phys. Review E* **58**, 4009-4011 (1998).
- 13) W. M. Gonçalves, R. D. Pinto, J. C. Sartorelli, and M. J. de Oliveira, Inferring statistical complexity in the dripping faucet experiment, *Physica A* **257**, 385-389 (1998).
- 14) J. G. M. da Silva, J. C. Sartorelli, W. M. Gonçalves, and R. D. Pinto, A scale law in a dripping Faucet, *Phys. Lett. A* **226**, 269 (1997);
- 15) M. S. F. da Rocha, J. C. Sartorelli, W. M. Gonçalves, and R. D. Pinto, Some dynamical aspects of the water drop formation in a leaky faucet, *Phys. Rev. E* **54**, 2378 (1996);
- 16) T. J. P. Penna, P. M. C. de Oliveira, J. C. Sartorelli, W. M. Gonçalves, and R. D. Pinto, Long-range anticorrelations and non-Gaussian behavior of a leaky faucet, *Phys. Rev. E* **52**, 2168R (1995);
- 17) R. D. Pinto, W. M. Gonçalves, J. C. Sartorelli, and M. J. de Oliveira, Hopf bifurcation in a leaky faucet experiment, *Phys. Rev. E* **52**, 6896 (1995);
- 18) J. C. Sartorelli, W. M. Gonçalves, and R. D. Pinto, Crisis and intermittence in a leaky faucet experiment, *Phys. Rev. E* **49**, 3963 (1994).

### **Participation in International Conferences:**

“Neural Information Processing: Analog simulations and experiments.”

R. D. Pinto, A. Szücs, R. Huerta, M. I. Rabinovich, A. I. Selverston, and H. D. I. Abarbanel.  
31<sup>st</sup> Annual Meeting Society for Neuroscience,  
November 10-15, 2001 – San Diego, CA, USA.

“DynClamp4: inserting simulated synapses and ionic conductances in up to four neurons.”

R. D. Pinto, R. C. Elson, A. Szücs, A. I. Selverston, M. I. Rabinovich, and H. D. I. Abarbanel.  
30<sup>th</sup> Annual Meeting Society for Neuroscience  
November 4-9, 2000 - New Orleans, LA, USA.

“Generation of oscillatory activity in small networks of interacting electronic and biological neurons.”

A. Szücs, R. D. Pinto, A. I. Selverston, P. Varona, M. I. Rabinovich, and H. D. I. Abarbanel.  
30<sup>th</sup> Annual Meeting Society for Neuroscience  
November 4-9, 2000 - New Orleans, LA, USA.

“Interior Crisis in a Dripping Faucet Experiment.”

R. D. Pinto, W. M. Gonçalves and J. C. Sartorelli,  
V Latin American Workshop on Nonlinear Phenomena  
September 28 - October 03, 1997 - Canela, RS, Brazil.

“Reconstruction of Computationally Equivalent Machines in the Dripping Faucet Experiment.”

W. M. Gonçalves, J. C. Sartorelli, R. D. Pinto and M. J. de Oliveira,  
V Latin American Workshop on Nonlinear Phenomena  
September 28 - October 03, 1997 - Canela, RS, Brazil.

“The Dripping Faucet: Chaotic or Critical Behavior?”

R. D. Pinto, W. M. Gonçalves, J. C. Sartorelli, P. M. C. de Oliveira, T. J. P. Penna, and A. R. de Lima.  
Workshop on Foundations of Statistical Mechanics and Thermodynamics  
October 20-24, 1997 - Natal, RN, Brazil.

“Topological Machine Reconstruction and Markovian Processes Modeling in the Dripping Faucet Experiment.”

W. M. Gonçalves, J. C. Sartorelli, R. D. Pinto and M. J. de Oliveira.  
Workshop on Foundations of Statistical Mechanics and Thermodynamics  
October 20-24, 1997 - Natal, RN, Brazil.

“Interior Crisis in a Dripping Faucet Experiment: Does it occur Homoclinic Chaos in a Dripping Faucet?”

R. D. Pinto, W. M. Gonçalves and J. C. Sartorelli.  
School on Non-Linear Dynamics 1997, ICCMP, UnB - Brasília, DF, Brazil.

“Reconstruction of topological  $\varepsilon$ -machine l-digraph in the dripping faucet experiment.”

W. M. Gonçalves, J. C. Sartorelli, R. D. Pinto and M. J. de Oliveira.  
School on Non-Linear Dynamics 1997, ICCMP, UnB - Brasília, DF, Brazil.

“Characteristic Periods in the Attractors of a Leaky Faucet Experiment.”

R. D. Pinto, J. G. M. da Silva, and J. C. Sartorelli.  
Non-linear Dynamics, Chaos, Control and their Applications in Engineering Sciences, American Academy of Mechanics and Associação Brasileira de Ciências Mecânicas, **1**, 212-217 (1997),  
Proceedings of ICONE - Second International Conference,  
Águas de São Pedro, SP, Brazil, 1996.

“Hopf bifurcation and scale law in a dripping faucet.”

J. G. M. da Silva, R. D. Pinto, W. M. Gonçalves, and J. C. Sartorelli.  
Non-linear Dynamics, Chaos, Control and their Applications in Engineering Sciences, American Academy of Mechanics and Associação Brasileira de Ciências Mecânicas, **1**, 195-200 (1997),  
Proceedings of ICONE - Second International Conference,

Águas de São Pedro, SP, Brazil, 1996.

“Complex behavior in a leaky faucet experiment.”

R. D. Pinto, W. M. Gonçalves, J. G. M. da Silva, A. Tufaile, and J. C. Sartorelli.  
Workshop on complex systems 1996, Brasília, DF, Brazil.

### **Participation in national conferences:**

“Nonlinear Dynamics of Information in Biological Neural Networks.”

R. D. Pinto, A. Szücs, H. D. I. Abarbanel, M. I. Rabinovich, and A. I. Selverston.  
XXIV Encontro Nacional de Física da Matéria Condensada  
May 15-19, 2001, São Lourenço - MG

“The role of dynamical synapses in neural information processing.”

R. D. Pinto, M. I. Rabinovich, A. I. Selverston, and H. D. I. Abarbanel.  
XXIV Encontro Nacional de Física da Matéria Condensada  
May 15-19, 2001, São Lourenço - MG

“Homoclinic Chaos in the dripping faucet experiment.”

R. D. Pinto, W. M. Gonçalves, and J. C. Sartorelli.  
XXI Encontro Nacional de Física da Matéria Condensada  
June 2-6, 1998 - Caxambu, MG, Brazil.

“Numerical integration of bubbles and drops.”

A. Tufaile, W. M. Gonçalves, R. D. Pinto, and J. C. Sartorelli.  
XXI Encontro Nacional de Física da Matéria Condensada  
June 2-6, 1998 - Caxambu, MG, Brazil.

“Chaotic Blue Sky catastrophe in a dripping faucet experiment.”

R. D. Pinto, W. M. Gonçalves, and J. C. Sartorelli.  
XXI Encontro Nacional de Física da Matéria Condensada  
June 2-6, 1998 - Caxambu, MG, Brazil.

“Henon-like attractors in the dripping faucet experiment.”

W. M. Gonçalves, R. D. Pinto, and J. C. Sartorelli.  
XXI Encontro Nacional de Física da Matéria Condensada  
June 2-6, 1998 - Caxambu, MG, Brazil.

“Oscillating Flames.”

M. B. Reyes, J. C. Sartorelli, A. Tufaile, R. D. Pinto, and W. M. Gonçalves.  
XXI Encontro Nacional de Física da Matéria Condensada  
June 2-6, 1998 - Caxambu, MG, Brazil.

“Is there Homoclinic Chaos in a dripping faucet experiment?”

R. D. Pinto, J. C. Sartorelli, M. S. Baptista, and I. L. Caldas.  
XX Encontro Nacional de Física da Matéria Condensada, 1997  
Caxambu, MG, Brazil.

“Smooth transition to chaos in a dripping faucet experiment.”

R. D. Pinto, J. C. Sartorelli, T. J. P. Penna, and P. M. C. de Oliveira.  
XX Encontro Nacional de Física da Matéria Condensada, 1997  
Caxambu, MG, Brazil.

“Torus breakup and Chaos in a dripping faucet experiment.”

R. D. Pinto, J. C. Sartorelli, M. S. Baptista, and I. L. Caldas.  
XX Encontro Nacional de Física da Matéria Condensada, 1997  
Caxambu, MG, Brazil.

“Markovian Processes in a dripping faucet experiment.”

W. M. Gonçalves, J. C. Sartorelli, and R. D. Pinto.  
XX Encontro Nacional de Física da Matéria Condensada, 1997  
Caxambu, MG, Brazil.

“Similarities Between Leaky Faucets and Hearts.”

A. R. Lima, T. J. P. Penna, P. M. C. de Oliveira, J. C. Sartorelli, W. M. Gonçalves, and R. D. Pinto.  
XX Encontro Nacional de Física da Matéria Condensada, 1997  
Caxambu, MG, Brazil.

“Complex behavior in a dripping faucet experiment.”

R. D. Pinto, J. G. M. da Silva, and J. C. Sartorelli.  
XX Encontro Nacional de Física da Matéria Condensada, 1996  
Águas de Lindóia, SP, Brazil;

“Measurement of successive time events using a data acquisition system developed for an IBM-PC.”

R. D. Pinto and J. C. Sartorelli.  
XX Encontro Nacional de Física da Matéria Condensada, 1996  
Águas de Lindóia, SP, Brazil;

“Simulation of big dripping faucets.”

A. R. de Lima, T. J. P. Penna, P. M. C. de Oliveira, J. C. Sartorelli, W. M. Gonçalves, and R. D. Pinto.  
XX Encontro Nacional de Física da Matéria Condensada, 1996  
Águas de Lindóia, SP, Brazil;

“Crisis and Hysteresis in a Dripping Faucet Experiment”



R. D. Pinto, J. G. M. da Silva, W. M. Gonçalves, and J. C. Sartorelli.  
IV Encontro Brasileiro de Física de Plasmas,  
Águas de Lindóia, SP, Brazil, 1996;

“Critical behavior in a leaky faucet experiment”

R. D. Pinto, W. M. Gonçalves, A. Tufaile, J. C. Sartorelli, T. J. P. Penna, and P. M. C. de Oliveira.

III Encontro Brasileiro de Física de Plasmas,  
Águas de Lindóia, SP, Brazil, 1995;

“A study of the water drop formation by video images”

M.S. F. da Rocha, J. C. Sartorelli, W. M. Gonçalves, and R. D. Pinto.

III Encontro Brasileiro de Física de Plasmas,  
Águas de Lindóia, SP, Brazil, 1995;

“Determination of embedding dimension of complex data set of dripping faucet experiment with the method of false nearest neighbors”

J. G. M. da Silva, R. D. Pinto, W. M. Gonçalves, A. Tufaile, and J. C. Sartorelli.

III Encontro Brasileiro de Física de Plasmas,  
Águas de Lindóia, SP, Brazil, 1995;

“Combination of logistic maps. A way to model the dripping water?”

A. Tufaile, R. D. Pinto, W. M. Gonçalves, and J. C. Sartorelli.

III Encontro Brasileiro de Física de Plasmas,  
Águas de Lindóia, SP, Brazil, 1995;

“Dynamics of formation of multiple drops at high dripping rates.”

A. Tufaile, R. D. Pinto, W. M. Gonçalves, and J. C. Sartorelli.

XVIII Encontro Nacional de Física da Matéria Condensada,  
Caxambu, MG, Brazil, 1995.

“Using algorithms to characterize chaotic data series from a dripping faucet experiment.”

J. G. M. da Silva, J. C. Sartorelli, W. M. Gonçalves, and R. D. Pinto.

XVIII Encontro Nacional de Física da Matéria Condensada,  
Caxambu, MG, Brazil, 1995;

“Study of water drops formation as a function of the water column.”

R. D. Pinto, W. M. Gonçalves, and J. C. Sartorelli.

XVIII Encontro Nacional de Física da Matéria Condensada,  
Caxambu, MG, Brazil, 1995;

“Role of the shape of the nozzle in a dripping faucet experiment.”

W. M. Gonçalves, R. D. Pinto, and J. C. Sartorelli.

XVIII Encontro Nacional de Física da Matéria Condensada,

Caxambu, MG, Brazil, 1995;

“Determining the time evolution of water drops formation.”

M. S. F. da Rocha, J. C. Sartorelli, W. M. Gonçalves, and R. D. Pinto.  
XVIII Encontro Nacional de Física da Matéria Condensada,  
Caxambu, MG, Brazil, 1995;

“Periodic and quasi-periodic regimes in a dripping faucet experiment.”

R. D. Pinto, J. C. Sartorelli, M. J. de Oliveira, and W. M. Gonçalves.  
XVII Encontro Nacional de Física da Matéria Condensada,  
Caxambu, MG, Brazil, 1994;

“Study of periodic and quasi-periodic regimes in a dripping faucet experiment using the correlation dimension.”

J. G. M. da Silva, J. C. Sartorelli, W. M. Gonçalves, and R. D. Pinto.  
XVII Encontro Nacional de Física da Matéria Condensada,  
Caxambu, MG, Brazil, 1994;

“Sudden changes in chaotic regimes in a leaky faucet experiment”

J. C. Sartorelli, W. M. Gonçalves, and R. D. Pinto.  
II Encontro Brasileiro de Física de Plasmas,  
Serra Negra, SP, Brazil, 1993;

“Converting an ADC from Apple to IBM-PC.”

R. D. Pinto, W. M. Gonçalves, M. C. S. Rosa, and J. C. Sartorelli.  
XVI Encontro Nacional de Física da Matéria Condensada,  
Caxambu, MG, Brazil, 1992;

“The dripping faucet experiment.”

W. M. Gonçalves, R. D. Pinto, and J. C. Sartorelli.  
XIV Encontro Nacional de Física da Matéria Condensada,  
Caxambu, MG, Brazil, 1991.

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Reynaldo Daniel Pinto  
São Paulo, March 22<sup>nd</sup>, 2002