

# CURRICULUM VITAE

## SUSHKO IRYNA

**Name:** SUSHKO Iryna Mykhailivna

**Born:** 15.01.1967, Kyiv region, Ukraine

**Citizenship:** Ukraine

**Academic position:** Senior Scientific Researcher, Institute of Mathematics, National Academy of Sciences of Ukraine

**Address:**

*Office*

Institute of Mathematics, NASU

3, Tereshchenkivska st., 01601 Kyiv-4 UKRAINE

**Tel:** +38 044 234-63-22

**Fax:** +38 044 235-20-10

**E-mail:** sushko@imath.kiev.ua; ira\_sushko@hotmail.com

*Home*

Acad. Bulakhovskogo st. 5B, ap. 161

03164 Kyiv UKRAINE

**Tel:** +38 044 496-43-77; +38 050 443 48 24 (mob.)

**Marital status:** Married, two children

**Languages:** Ukrainian (native), Russian (native), English, Italian (basic)

### Education and Scientific Employment

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|-----------------------------|---|
| 1984-1989                   | Cybernetics Faculty, Kiev State University, Diploma of mathematician (Master's degree)  |
| 1989-1992                   | Postgraduate course, Institute of Mathematics, NASU<br>(supervisors: Prof. A. Sharkovsky and Prof. Yu. Maistrenko)                    |
| Feb. 1993                   | Academic Degree of Candidate of Sciences in Physics and Mathematics (PhD)   |
| 1993-2002                   | Scientific Researcher, Ordinary Differential Equations Dept., Institute of Mathematics, NASU  |
| 2002-present                | Senior Scientific Researcher, Dept. of Differential Equations and Oscillation Theory,<br>Institute of Mathematics, NASU               |
| Sep. 2004 -<br>Sep. 2005    | Scientific Researcher, University of Urbino, Italy<br>(Marie Curie Fellowship within the 6-th European Community Framework Programme) |
| Nov. 2009 -<br>July 2017    | Visiting Professor at the Kyiv School of Economics<br>(Economics Education and Research Consortium, Inc)                              |
| Feb., March,<br>Sept., 2016 | Visiting Professor at the University of Urbino, Italy<br>(Dept. of Economics, Society and Politics)                                   |

### Scientific Interests

- Theory of nonlinear dynamical systems: regular and chaotic attractors, basins of attraction, bifurcation structure of parameter space, routes to chaos;
- Piecewise smooth dynamical systems: border collision bifurcations, normal forms, degenerate bifurcations, dangerous bifurcations;
- Synchronization of periodic, quasiperiodic and chaotic processes;
- Applications in radioengineering (autooscillating systems), economics (business cycle models, growth models, new economic geography models, etc.).

### Research Projects, Fellowships, Grants

1. Complex dynamics of two-loops autooscillating systems (1988-1990, in cooperation with Moscow Institute of Radioengineering and Electronics of the USSR Academy of Sciences);
2. Structures emergence in the problems of thermoconductivity and emission (1990-1991, in cooperation with Physics and Engineering Institute of the Uzbek SSR Academy of Sciences);
3. Elaboration of new methods, algorithms and software for nonlinear dynamical systems (1991-1993, grant of the Academy of Sciences of Ukraine);
4. Investigation of mechanisms of bifurcations and chaos in two-dimensional maps (1993-1999, grant of the Academy of Sciences of Ukraine);
5. Cycles and chaotic invariant sets of two-dimensional endomorphisms generated by second order difference equation (1995, grant of the Int. Sci. Foundation);
6. Nonlinear Dynamics and Communications (1996, grant of the Swiss NSF);
7. Complex Dynamics of Duopoly Models (2001, grant of Istituto Nazionale di Alta Matematica Francesco Severi);
8. Bertrand Oligopoly (2001, grant of The Swedish Institute).
9. The fellowship by the Landau Network/Cariplo Foundation (2002, 2003, Universita Cattolica del Sacro Cuore, Milan, Italy).
10. The Marie-Curie International Fellowship within the 6<sup>th</sup> European Community Framework Programme **FP6** (Sept. 2004 - Sept. 2005, University of Urbino, Italy).
11. Italian Research Project of Relevant National Interest (**PRIN**-2009) "Local interactions and global dynamics in economics and finance: models and tools" (2011-2012).
12. European Cooperation in the field of Scientific and Technical Research (**COST**), Action IS1104: "The EU in the new complex geography of economic systems: models, tools and policy evaluation" (2012-2016).

### International Conferences and Workshops

1. Inter. School-Conf. on Dynamical Systems (Trieste, Italy, 1991). The title of contribution: "On some family of two-dimensional piecewise linear maps".
2. Czech-Slovak Conf. on Differential Equations and Their Applications EQUADIFF 8 (Bratislava, Slovakia, 1993): "Period adding phenomenon on two-dimensional piecewise linear maps".
3. Int. Workshop on Infinite Dimensional Evolution Processes (Trieste, Italy, 1993): "On some family of two-dimensional piecewise linear family".
4. Int. School-Conf. "Differential Equations: Bifurcation and Chaos" (Crimea, Ukraine, 1994): "Two-dimensional piecewise linear endomorphisms: period adding phenomenon".
5. Int. Conf. on Nonlinear Dynamics of Electronic Systems - NDES 1994 (Krakow, Poland): "Period adding phenomenon in piecewise linear endomorphisms arising from electronic systems".
6. Int. Conf. "Dynamics Days" (Budapest, Hungary, 1994): "Period adding phenomenon in piecewise linear endomorphisms".
7. Int. Workshop on Dynamical Systems (Moscow, Russia, 1994).
8. Int. Conf. on Nonlinear Dynamics, Chaotic and Complex Systems (Zakopane, Poland, 1995): "Bifurcation phenomena for two-dimensional piecewise linear maps".
9. Int. School-Conf. "Chaos. The Interplay Between Stochastic, Classics and Quanta" (Karpacz, Poland, 1995): "Period adding phenomenon in piecewise linear endomorphisms".
10. European Conf. on Iteration Theory **ECIT** 1996 (Urbino, Italy): "Chaotic attractors at the transition from invertible to noninvertible maps in two-dimensional piecewise linear family".
11. Int. Workshop and Seminar "Beyond Quasiperiodicity: Complex Structures and Dynamics" (Dresden, Germany, 1999): "Bifurcation phenomena for two-dimensional piecewise linear maps".
12. Int. Conf. on Discrete Chaotic Dynamics in Nature and Society (Odense, Denmark, 2000): "Influence of quasiperiodic forcing on synchronization processes".
13. Int. Workshop "The Mathematics of Dynamic Economic Models" (Copenhagen, Denmark, 2000): "Two-Dimensional Discrete-Time Dynamical Systems".
14. Int. Workshop on Dynamic Models in Economics and Finance **MDEF** 2000 (Urbino, Italy): "An example of irregular growth cycles model".
15. Int. Conf. "Oligopoly and Complex Dynamics: Methods and Models" (Umea, Sweden, 2001): "Complex Dynamics of the Generalized Palander Duopoly Model".
16. Int. Workshop "Oligopoly Games and Complexity" (Urbino, Italy, 2002): "Duopoly by Palander with discontinuous reaction functions".

17. MDEF 2002 (Urbino, Italy): "Business Cycle: The Hicksian Floor-Roof Model Revisited".
18. Italian Meeting on Game Theory and Application (Urbino, Italy, 2003): "Duopoly with Piecewise Linear Discontinuous Reaction Functions".
19. Int. Conf. on Nonlinear Economic Dynamics **NED** 2004 (Tokyo, Japan): "The Hicksian Floor-Roof Model for two Regions Linked by Interregional Trade".
20. MDEF 2004 (Urbino, Italy): "Bistability and Border-Collision Bifurcations for a Family of Piecewise Smooth Unimodal Maps".
21. Int. Workshop "Bifurcations in Nonsmooth and Hybrid Dynamical Systems" (Milan, Italy, 2004): "Bistability and Border-Collision Bifurcations for a Family of Unimodal Piecewise Smooth Maps".
22. Int. Workshop "Complexity and Randomness in Economic Dynamical Systems", Bielefeld Graduate School of Economics and Management, University of Bielefeld, Germany (Mar. 17-19, 2005): "Center-like Bifurcation for 2Dim Piecewise Linear Maps".
23. Int. Conf. "Keynesian Macrodynamics - the Multiplier-Accelerator Model Revisited", University of Umeå, Sweden (June 10-11, 2005): "Hicksian Business Cycle Model with Smooth and Piecewise Linear Investment Function".
24. Int. Workshop "Functional Analysis Methods in Economics and Finance", University of Calabria, Cosenza, Italy (July 7-9, 2005): "Border-Collision Bifurcation Curves in an Irregular Growth Cycles Model".
25. NED 2005 (Urbino, Italy, July 28-30): "Border-collision bifurcation in Duopoly Model with Capacity Limits".
26. European Marie Curie Conf. "Putting the Knowledge Based Society into Practice" (University of Manchester, UK, April 10-12, 2006): "Dynamical behavior and bifurcations in noninvertible maps of the plane and of the space".
27. ECIT 2006 (Gargnano, Italy, Sept. 10-16): "Center Bifurcation for a Two-Dimensional Piecewise Linear Map".
28. MDEF 2006 (University of Urbino, Italy, Sept. 21-23).
29. ECIT 2008 (Yalta, Ukraine, Sept. 7-13): "On analogue of the center bifurcation at infinity".
30. MDEF 2008 (University of Urbino, Italy, Sept. 25-27): "Regular and Chaotic Growth in a Hicksian Floor/Ceiling Model".
31. NED 2009 (Yonkoping, Sweden, May 31 - June 2): "Center Bifurcation of a point on the Poincaré Equator".
32. Ukrainian Mathematical Congress (Kiev, Ukraine, Aug. 27-29, 2009): "Degenerate Bifurcations and Border Collision in One- and Two-dimensional Piecewise Smooth Maps".
33. Int. Workshop on Nonlinear Maps and their Applications **NOMA** 2009 (Urbino, Italy, Sept. 10-11): "Degenerate bifurcations in one- and two-dimensional piecewise smooth maps".
34. ECIT 2010 (Nant, France, Sept. 12-17): "Center Bifurcation in the Lozi Map".
35. MDEF 2010 (University of Urbino, Italy, Sept. 23-25): "Border Collision Bifurcations in a simple oligopoly model with production constraints".
36. NED 2011 (Cartagena, Spain, June 1-3): "Cycles and Chaotic Attractors in an Infinitely Lived Agent Economy".
37. NOMA 2011 (University of Evora, Portugal, Sept. 15-16): "Border Collision Normal Forms for One- and Two-Dimensional Maps".
38. ECIT 2012 (Ponta Delgada, San Miguel Island, Azores, Portugal, Sept. 9-15): "Bifurcation structure in a piecewise smooth map with two kink points".
39. COST Meeting (University of Urbino, Italy, Sept. 18-19, 2012).
40. MDEF 2012 (University of Urbino, Italy, Sept. 20-22): "Global dynamics of a three-region new economic geography model".
41. SIAM Conference on Applications of Dynamical Systems (Snowbird, Utah, USA, May 19-23, 2013): "Bifurcation Structure in a Piecewise Smooth Map with Two Kink Points".
42. NED 2013 (Siena, Italy, July 4-6): "Dynamics of a New Economic Geography Model in the Presence of an Outside region".
43. MDEF 2014 (University of Urbino, Italy, Sept. 18-20): "Bull and Bear market with different entry thresholds".
44. NED 2015 (Tokyo, Japan, June 25-27): "Dynamics of a two-country New Economic Geography model with four regions".
45. Int. Conference on Open Problem in Nonsmooth Dynamics (Autonomous University of Barcelona, Spain, Feb. 1-5, 2016): "2D Border Collision Normal Form and Smale Horseshoe Construction".
46. Final Conference of COST Action "The EU in the new complex geography of economic systems: Models, tools and policy evaluation" (May 26-27, 2016, Heraklion, Crete, Greece): "The dynamics of a three-region linear NEG model".
47. MDEF 2016 (University of Urbino, Italy, June 23-25): "Globalization and Coupled Chaotic Fluctuations of Innovation".

48. ECIT 2016 (University of Innsbruck, Austria, Sept.4-10): "Codimension-two bifurcations and robust chaos in a 1D piecewise smooth map".

49. Progress on Difference Equations **PODE** 2017 (University of Urbino, May 29-31): "Smale Horseshoe in 2D Noninvertible Maps".

### Teaching Experience

- Kyiv School of Economics, *Mathematics for Economists* course (2009-2017).

### Invited lecturer

1. Int. School on Discrete Dynamical Systems (Urbino, Italy, 2004).
2. Tutorial Workshop "Nonlinear Dynamics in Economic Modelling", University of Trento, CIFREM, Italy (March 12-13, 2009).
3. Tutorial Workshop "Discrete Dynamical Systems and Applications" (Urbino, June 30 - July 3, 2010).
4. Tutorial Workshop "Topics in Nonlinear Dynamics: Nonlinear Dynamics of Piecewise-Smooth Dynamical Systems" (Urbino, Sept. 21-23, 2011).
5. Tutorial Workshop "Topics in Nonlinear Dynamics. Bifurcations in Piecewise-Smooth Systems: Perspectives, Methodologies and Open Problems" (Urbino, Sept. 11-16, 2013).
6. Training School "On Qualitative Theory of Dynamical Systems, Tools and Applications", (Urbino, Sept.17-19, 2015).

### Invited Researcher, Visiting Professor, seminar talks

1. National Inst. of Applied Sciences (Toulouse, France, Dec. 1993).
2. Dept. of Economics, Univ. of Urbino (Italy, Sept. 1994, Mar. 1997, Feb.-Mar. 2001, Mar. 2008, Sept.-Oct. 2009-2015).
3. Technical Univ. of Denmark (Lyngby, Dec. 1996, Aug. 1999).
4. Swiss Federal Inst. of Technology (Lausanne, Switzerland, Feb. 1997).
5. Heriot-Watt Univ. of Edinburgh (UK, May 1999).
6. Univ. of Potsdam (Germany, Mar. 1999, Oct. 1999).
7. Univ. of Odense (Denmark, Apr. 2000, Apr.-May 2001, Sept.-Oct. 2001).
8. Isak Newton Inst. for Math. Sci., Cambridge Univ. (UK, Oct. 2002).
9. Univ. of Umea (Sweden, June 2001, June 2003, Mar. 2008).
10. Universita Cattolica del Sacro Cuore (Milan, Italy, Feb.-March, May-June, 2002; Nov.-Dec. 2003; Feb.-March 2004).
11. Univ. of Napoli, Dept. of Math. and Stat. (Italy, Sept. 29, 2004).
12. Univ. of Bristol, Dept. of Engineering Math. (UK, Feb. 14-21, 2005).
13. Univ. of Genova, Dept. of Math. (Italy, Mar. 14, 2005).
14. Univ. of Bologna, Dept. of Math. (Italy, Apr. 14, 2005).
15. Univ. of Piacenza, Dept. of Economics (Italy, May 6, 2005).
16. Univ. of Calabria, Dept. of Admin. Sci. (Rende, Italy 2005, Oct. 2009).

17. Weierstrass Inst. for Applied Analysis and Stochastics (Berlin, Germany, Aug. 23-27, 2005, Dec. 4-22, 2006).
18. Instituto Superior Tecnico, Dept. de Matematica (Lisbon, Nov. 2006).
19. Univ. of Stuttgart, Inst. of Parallel and Distributed Systems (March 15-21, 2010, Oct. 2010, Feb. 2011).
20. Visiting Prof., DESP, University of Urbino (Feb.-March, Sept. 2016, March, July, Sept. 2017).

#### **Member of Organizing Committees**

1. Int. School-Workshop on Dynamical Systems and Turbulence (1991, Crimea, Ukraine).
2. Int. School-Conf. "Differential Equations: Bifurcations and Chaos" (1994, Crimea, Ukraine).
3. European Conf. on Iteration Theory (Yalta, Crimea, Ukraine, Sep. 7-13, 2008).

#### **Member of Scientific Committee**

1. Int. Conf. on Nonlinear Economic Dynamics NED (Sweden, 2009, Spain 2011).
2. Int. Workshop on Dynamic Models in Economics and Finance MDEF (Italy, 2012, 2014).

#### **Referee for Journals**

Physica D, Chaos, Math. and Computers in Simulation, Int. J. of Bifurcations and Chaos, J. of Economic Dynamics and Control, Nonlinear Dynamics, Mathematical and Computer Modelling, Discrete Dynamics in Nature and Society, Computational Economics, Applied Mathematical Modelling, Nonlinear Phenomena, Communications in Nonlinear Science and Numerical Simulation, Chaos Solitons & Fractals, Applied Mathematics and Computation, Structural Change and Economic Dynamics, Entropy, Differential Equations and Dynamical Systems.

**Author** of 122 scientific publications.

## List of publications

### *PhD Thesis, Preprints and Working Papers (9)*

1. V. L. Maistrenko, Yu. L. Maistrenko, I. M. Sushko. On one noninvertible plane map arising in radiophysics. *Preprint of the Institute of Mathematics of the Academy of Science of Ukraine*, 1992, 33 p.
2. Yu. L. Maistrenko, V. L. Maistrenko, I. M. Sushko. Attractors of piecewise linear maps of straight line and plane. *Preprint of the Institute of Mathematics of the Academy of Sciences of Ukraine*, 1992, 55 p.
3. I. M. Sushko. Thesis "Stability and bifurcations of solutions of the families of difference equations with two deviations of argument". *Institute of Mathematics of the Academy of Sciences of Ukraine*, 1993, 76 p.
4. P. Commendatore, I. Kubin, C. Petraglia and I. Sushko. Economic integration and agglomeration in a customs union in the presence of an outside region. *Vienna University of Economics and Business Administration, Dept. of Economics, Working Paper No. 146, Oct. 2012*.
5. V. Avrutin, I. Sushko, F. Tramontana. Bifurcation structure in a bimodal piecewise linear business cycle model. *DEM Working Paper Series, University of Pavia, 76 (04-14)*.
6. I. Sushko, L. Gardini, K. Matsuyama. Chaos in a Model of Credit Cycles with Good and Bad Projects. *Working Papers Series in Economics, Mathematics and Statistics, University of Urbino, No.2014/05*.
7. K. Matsuyama, I. Sushko, L. Gardini. Revisiting the model of credit cycles with good and bad projects. *Geocomplexity: discussion papers series*, February 2015, No. 8/2015.
8. K. Matsuyama, I. Sushko, L. Gardini. Globalization and Synchronization of Innovation Cycles. *Geocomplexity: discussion papers series*, February 2015, No. 9/2015.
9. L. Gardini, R. Makrooni, I. Sushko. Cascades of Alternating Smooth Bifurcations and Border Collision Bifurcations in a Family of Discontinuous Linear-Power Maps. *Geocomplexity: discussion papers series*, February 2016, No. 3/2016.

### *Articles (45)*

10. V. L. Maistrenko, Yu. L. Maistrenko, I. M. Sushko. Noninvertible two-dimensional maps arising in radiophysics. *Int. J. Bifurcation and Chaos, Vol. 4, No. 2 (1994) 383-400*.
11. Yu. L. Maistrenko, V. L. Maistrenko, I. M. Sushko. Bifurcation phenomena in generators with delay lines. *J. Radioengineering and electronics, Moscow, No. 8-9, 1994, 1367-1380*.
12. Ch. Mira, Ch. Rauzy, Yu. L. Maistrenko, I. M. Sushko. Some properties of a two-dimensional piecewise-linear noninvertible map, *Int. J. Bifurcation and Chaos, Vol. 6, No. 12A (1996), 2299-2319*.
13. Yu. L. Maistrenko and I. M. Sushko. Bifurcation phenomena for two-dimensional piecewise linear maps, *J. Tech. Phys., Vol. 37, No. 3-4 (1996), 371-378*.
14. Yu. Maistrenko, I. Sushko and L. Gardini. About Two Mechanisms of Reunion of Chaotic Attractors, *Chaos, Solitons & Fractals, Vol.9, No.8, (1998), 1373-1390*.
15. E. Neumann, I. Sushko, Yu. Maistrenko, U. Feudel. Synchronization and desynchronization under the influence of quasiperiodic forcing. *Physical Review E 67, 026202, 2003*.
16. G. Kristensen, S. Yanchuk, I. Sushko. Dynamical Approach to Complex Regional Economic Growth based on Keynesian Model for China. *Chaos, Solitons & Fractals, Vol.18, No.5 (2003), 937-952*.
17. I. Sushko, T. Puu and L. Gardini. The Hicksian Floor-Roof Model for two Regions Linked by Interregional Trade. *Chaos, Solitons & Fractals, Vol.18, No.3 (2003), 593-612*.
18. M. Gallegati, L. Gardini, T. Puu and I. Sushko. Hicks' Trade Cycle Revisited: Cycles and Bifurcations, *Mathematics and Computers in Simulation, 63 (2003). 505-527*.

19. T. Puu, I. Sushko. A Business Cycle Model with Cubic Nonlinearity, *Chaos, Solitons & Fractals*, Vol. 19, (2004), 597-612.
20. I. Sushko, L. Gardini, T. Puu. Tongues of Periodicity in a Family of Two-dimensional Discontinuous Maps of Real Möbius Type, *Chaos, Solitons & Fractals* 21 (2004), 403-412.
21. G. Kristensen, I. Sushko. Complex Market Dynamics under Box-Cox Monopoly, *Chaos, Solitons & Fractals* 21 (2004), 591-602.
22. T. Puu, L. Gardini, I. Sushko. A Hicksian Multiplier-Accelerator Model with Floor Determined by Capital Stock, *Journal of Economic Behaviour and Organization*, Vol. 56 (2005), 331-348.
23. I. Sushko, A. Agliari, L. Gardini. Bistability and Border-Collision Bifurcations for a Family of Unimodal Piecewise Smooth Maps. *Discrete and Continuous Dynamical Systems, Series B* (2005), Vol. 5, N 3, 881-897.
24. G.-I. Bischi, I. Sushko. Foreword "Dynamic Modelling in Economics and Finance" in honour of Professor Carl Chiarella, *Chaos, Solitons & Fractals*, Vol. 29, Issue 3 (2006), 515-516.
25. T. Puu, L. Gardini, I. Sushko. On the Change of Periodicities in the Hicksian Multiplier-Accelerator Model with a Consumption Floor. *Dynamic Modelling in Economics and Finance in honour of Professor Carl Chiarella* (G.I. Bischi and I. Sushko Ed.s), *Chaos, Solitons & Fractals*, Vol. 29, Issue 3 (2006), 681-696.
26. I. Sushko, A. Agliari, L. Gardini. Bifurcation Structure of Parameter Plane for a Family of Unimodal Piecewise Smooth Maps: Border-Collision Bifurcation Curves. *Dynamic Modelling in Economics and Finance in honour of Professor Carl Chiarella* (G.I. Bischi and I. Sushko Ed.s), *Chaos, Solitons & Fractals*, Vol. 29, Issue 3 (2006), 756-770.
27. I. Sushko, L. Gardini. Center Bifurcation for Two-Dimensional Border-Collision Normal Form, *Int. J. Bifurcation and Chaos*, Vol. 18, Issue 4 (2008), 1029-1050.
28. L. Gardini, I. Sushko, A. Naimzada. Growing Through Chaotic Intervals. *Journal of Economic Theory* 143 (2008), 541-557.
29. I. Sushko, M. Wegener, F. Westerhoff, G. Zaklan. Endogenous business cycle dynamics within the inventory model of Metzler: Adding an inventory floor. *Nonlinear Dynamics, Psychology and Life Sciences*, Vol. 13, No. 2 (2009), 225-235.
30. I. Sushko, L. Gardini, T. Puu. Regular and Chaotic Growth in a Hicksian Floor/Ceiling Model. *Journal of Economic Behaviour and Organization*, 75 (2010), 77-94.
31. S. Brianzoni, E. Michetti, I. Sushko. Border Collision Bifurcations of Superstable Cycles in a One-Dimensional Piecewise Smooth Map. *Mathematics and Computers in Simulation*, Vol. 81, Issue 1 (2010), 52-61.
32. I. Sushko, L. Gardini. Degenerate Bifurcations and Border Collisions in Piecewise Smooth 1D and 2D Maps. *Int. J. Bifurcation and Chaos*, Vol. 20, No. 7 (2010), 2045-2070.
33. L. Gardini, F. Tramontana, I. Sushko. Border Collision Bifurcations in one-dimensional linear-hyperbolic maps, *Mathematics and Computers in Simulation*, Vol. 81, Issue 4 (2010), 899-914.
34. L. Gardini, I. Sushko, V. Avrutin, M. Schanz. Critical homoclinic orbits lead to snap-back repellers. *Chaos, Solitons & Fractals*, 44 (2011) 433-449.
35. G.-I. Bischi, F. Lamantia, I. Sushko. Border Collision Bifurcations in a simple oligopoly model with production constraints. *Int. J. Appl. Math. and Statistics*, Vol. 26, No. 2 (2012), 121-135.
36. A. Panchuk, I. Sushko, B. Schenke, V. Avrutin. Bifurcation Structure in Bimodal Piecewise Linear Map. *Int. J. Bifurcation and Chaos*, Vol. 23, No. 12 (2013).
37. V. Avrutin, I. Sushko, L. Gardini. Cyclicity of chaotic attractors in one-dimensional discontinuous maps. *Mathematics and Computers in Simulation*, 95 (2014) 126-136.

38. P. Commendatore, A. Pinto, I. Sushko. A simple post-Keynesian model of growth with a financial constraint on investment. *Structural Change and Economic Dynamics*, Vol. 28 (2014) 12-24.
39. I. Sushko, L. Gardini, K. Matsuyama. Superstable Credit Cycles and U-sequence. *Chaos, Solitons & Fractals*, Vol. 59 (2014) 13–27.
40. L. Gardini, V. Avrutin, I. Sushko. Codimension-2 border collision bifurcations in one-dimensional discontinuous piecewise smooth maps. *Int. J. Bifurcation and Chaos*, Vol. 24, No. 2 (2014) 1450024 (30 pages).
41. C. Petraglia, P. Commendatore, I. Kubin, I. Sushko. Regional integration, international liberalisation and the dynamics of industrial agglomeration. *Journal of Economic Dynamics and Control* 48 (2014) 265–287, <http://dx.doi.org/10.1016/j.jedc.2014.07.011>.
42. V. Avrutin, L. Gardini, M. Schanz, I. Sushko. Bifurcations of Chaotic Attractors in One-Dimensional Maps, *Int. J. Bifurcation and Chaos*. Vol. 24, No. 8 (2014) 1440012 (10 pages).
43. V. Avrutin, I. Sushko, F. Tramontana. Bifurcation structure in a bimodal piecewise linear business cycle model. *Abstract and Applied Analysis*, Volume 2014, Article ID 401319, 12 pages, <http://dx.doi.org/10.1155/2014/401319>.
44. P. Commendatore, I. Kubin, I. Sushko. Typical Bifurcation Scenario in a Three Region Symmetric New Economic Geography Model. *Mathematics and Computers in Simulation*, 108 (2015) 63–80, <http://dx.doi.org/10.1016/j.matcom.2014.01.004>.
45. F. Tramontana, I. Sushko, V. Avrutin. Period adding structure in a 2D discontinuous model of economic growth. *Applied Mathematics and Computation*, 253 (2015) 262–273.
46. A. Panchuk, I. Sushko, V. Avrutin. Bifurcation structures in a bimodal piecewise linear map: chaotic dynamics. *Int. J. Bifurcation and Chaos*, (2015), doi: 10.1016/j.chaos.2015.03.013.
47. I. Sushko, F. Tramontana, F. Westerhoff, V. Avrutin. Symmetry breaking in a bull and bear financial market model. *Chaos, Solitons & Fractals* 79 (2015) 57-72.
48. P. Commendatore, I. Kubin, P. Mossay, I. Sushko. Dynamic agglomeration patterns in a two-country NEG model with four regions. *Chaos, Solitons & Fractals*, 79 (2015) 2-17.
49. R. Makrooni, L. Gardini, I. Sushko. Bifurcation structures in a family of 1D discontinuous linear-hyperbolic invertible maps. *Int. J. Bifurcation and Chaos*, Vol. 25, No. 13 (2015) 1530039 (21 pages).
50. I. Sushko, V. Avrutin, L. Gardini. Bifurcation structure in the skew tent map and its application as a border collision normal form. *Journal of Difference Equations and Applications* (2015) DOI: 10.1080/10236198.2015.1113273.
51. K. Matsuyama, I. Sushko, L. Gardini. Revisiting the Model of Credit Cycles with Good and Bad Projects. *Journal of Economic Theory* 163 (2016) 525–556.
52. I. Sushko, L. Gardini, K. Matsuyama. Robust chaos in a credit cycle model defined by a one-dimensional piecewise smooth map. *Chaos, Solitons & Fractals*, 91 (2016) 299–309.
53. I. Sushko, L. Gardini, V. Avrutin. Nonsmooth One-dimensional Maps: Some Basic Concepts and Definitions. *Journal of Difference Equations and Applications* (2016) DOI: 10.1080/10236198.2016.1248426.
54. V. Avrutin, Zh. Zhusubaliyev, A. Saha, S. Banerjee, I. Sushko and L. Gardini. Dangerous bifurcations revisited. *Int. J. Bifurcation and Chaos*, Vol. 26, No. 14 (2016) 1630040 (24 pages).
55. A. Panchuk, I. Sushko, V. Avrutin. Bifurcation structures in a bimodal piecewise linear map. *Frontiers in Applied Mathematics and Statistics* May 2017, Vol 3, Article 7, DOI: 10.3389/fams.2017.00007.
56. E. Ekaterinchuk, J. Jungeilges, T. Ryazanova, I. Sushko. Dynamics of a minimal consumer network with unidirectional influence. *Journal of Evolutionary Economics* 2017, DOI: 10.1007/s00191-017-0517-5.
57. P. Commendatore, I. Kubin, P. Mossay, I. Sushko. The role of centrality and market size in a 4-region asymmetric new economic geography model. *Journal of Evolutionary Economics* 2017 (to appear).

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