Curriculum Vitae

of

Nikolaos Sofronidis*

Education

1. Doctoral degree in economic sciences from the University of Macedonia (26 February 2004)
2. Doctoral degree in mathematical sciences from the California Institute of Technology (11 June 1999)

   (**http : //genealogy.math.ndsu.nodak.edu/id.php?id = 38161**)
3. Bachelor degree in mathematical sciences from the Aristotle University of Thessaloniki (13 July 1995)

Work Experience

As a special collaborator according to the Law 407 of the Department of Economic Sciences of the Aristotle University of Thessaloniki, I taught independently during the academic years 2001-2004 and as a special collaborator according to the Law 407 of the Department of Mathematical Sciences of the University of Crete, I taught independently during the academic years 2005-2007. I am an Assistant Professor of the Department of Economic Sciences of the University of Ioannina since the fall semester of 2007 and a Tenured Assistant Professor of the Department of Economic Sciences of the University of Ioannina since the Easter semester of 2011. I am a Tenured Associate Professor of the Department of Economic Sciences of the University of Ioannina since July 3, 2013. I am a Tenured Full Professor of the Department of Economic Sciences of the University of Ioannina since April 24, 2020.

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Research Publications

Doctoral Dissertations

1. N. E. Sofronidis, *Topics in descriptive set theory related to equivalence relations, complex Borel and analytic sets*, Ph.D. Thesis, California Institute of Technology, 1999, published by **UMI Dissertation Services**.

   Apart from article 1 in refereed research journals, in the framework of *ZF - Axiom of Foundation + Axiom of Countable Choice*, in such a way that every element of the spaces considered exists in visual space, which is computability theory or computable analysis or effective descriptive set theory (up to effective Baire class 1), for any computable $x \in P_3$, I define a computable sequence of computable real numbers $(a_n^x)_{n\in\mathbf{N}}$ such that the Dirichlet series $\mathbf{R} \ni s \mapsto \sum_{n=1}^{\infty} \frac{a_n^x}{n^s} \in \mathbf{R}$ is a computable function $\mathbf{R} \to \mathbf{R}$, where $P_3 = \left\{x \in 2^{(\mathbf{N}\setminus\{0\})\times(\mathbf{N}\setminus\{0\})} : \forall m \forall^\infty n(x(m,n) = 0)\right\}$.

2. N. E. Sofronidis, *Topics in economics from game theory, general equilibrium and macroeconomics*, Doctoral Dissertation, University of Macedonia, 2004, distributed by the **National Documentation Centre**.

   See articles 2 and 4 in refereed research journals.

Articles in refereed research journals

1. N. E. Sofronidis, *Natural examples of* $\mathbf{\Pi}_5^0$*-complete sets in analysis*, **Proceedings of the American Mathematical Society**, Volume 130, Number 4, 2001, pp. 1177-1182.

   In the framework of *ZF - Axiom of Foundation + Axiom of Countable Choice*, in such a way that every element of the spaces considered exists in visual space, which is computability theory or computable analysis or effective descriptive set theory (up to effective Baire class 1), for any computable $\alpha \geq 0$ and for any computable $x \in P_3$, I construct a computable entire function f_x such that the computable order of f_x is α, where $P_3 = \left\{x \in 2^{\mathbf{N}\times\mathbf{N}} : \forall m \forall^\infty n(x(m,n) = 0)\right\}$.

2. N. E. Sofronidis, *Mathematical economics and descriptive set theory*, **Journal of Mathematical Analysis and Applications**, Volume 264 (2001), pp. 182–205.

   In the framework of *ZF - Axiom of Foundation + Axiom of Countable Choice*, in such a way that every element of the spaces considered exists in visual space, which is computability theory or computable analysis or effective descriptive set theory (up to effective Baire class 1) and which is legal philosophy, I construct a computable pairwise exchange economy $E = ((\omega_1, u_1), (\omega_2, u_2)) \in \left(\left(\mathbf{R}_+^2 \setminus \{(0,0)\}\right) \times C^\infty\left(\mathbf{R}_+^2, \mathbf{R}\right)\right)^2$ without a Walrasian equilibrium.

3. N. E. Sofronidis, *Turbulence phenomena in elementary real analysis*, **Real Analysis Exchange**, Volume 29, Number 2, 2003/2004, pp. 813-820.

   In the framework of *ZF - Axiom of Foundation + Axiom of Countable Choice*, in such a way that every element of the spaces considered exists in visual space, which is computability theory or computable analysis or effective descriptive set theory (up to effective Baire class 1), if α, β, η, θ are rational numbers such that $0 < \eta < \beta - \alpha$ and $\alpha + \eta + \theta < \beta$, while $g(x) \in \mathbf{Q}[x] \cap C\left([\alpha, \beta), \mathbf{R}_+^*\right)$ and $f(x) \in \mathbf{Q}[x] \cap C\left([\alpha, \beta), \mathbf{R}_+^*\right)$, then $h \in C\left([\alpha, \beta), \mathbf{R}_+^*\right)$ is computable and takes rational values on the rational numbers in a primitive recursive way, while it connects $g(x)$ with $f(x)$.

4. N. E. Sofronidis, *Undecidability of the existence of pure Nash equilibria*, **Economic Theory**, Volume 23 (2004), pp. 423-428.

   In the framework of *ZF - Axiom of Foundation*, in such a way that every element of the spaces considered exists in visual space, which is computability theory, I prove that for any $n \geq 1$, there exists no Turing machine, which decides for any strategic n-person game, which is played by n Turing machines, whether or not it has at least one pure Nash equilibrium.

5. N. E. Sofronidis, Downsian competition with four parties, **Mathematical Social Sciences**, Volume 50 (2005), pp. 331-335.

   In the framework of *ZF - Axiom of Foundation + Axiom of Countable Choice*, in such a way that every element of the spaces considered exists in visual space, which is computability theory or computable analysis or effective descriptive set theory (up to effective Baire class 1), I prove that if $[0, 1]$ is a beam of mass 1 with positive mass density δ on $(0, 1)$, then in the strategic game $\mathcal{G}(\delta, 4)$ of placing under the beam four point supports, in such a way that each support accepts maximum mass, if ξ_i is the unique point of $[0, 1]$, for which $\int_0^{\xi_i} \delta(x)dx = \frac{i}{4}$, whenever $i \in \{1, 2, 3\}$, then $\mathcal{G}(\delta, 4)$ has a pure Nash equilibrium if and only if $\int_{\frac{\xi_1+t}{2}}^{\frac{t+\xi_3}{2}} \delta(x)dx \leq \frac{1}{4}$ for every $t \in (\xi_1, \xi_3)$ and at the pure Nash equilibrium of $\mathcal{G}(\delta, 4)$ exactly two out of the four supports are placed at ξ_1 and exactly two out of the four supports are placed at ξ_3.

6. N. E. Sofronidis, *Turbulence phenomena in real analysis*, **Archive for Mathematical Logic**, Volume 44 (2005), pp. 801-815.

   In the framework of *ZF - Axiom of Foundation + Axiom of Countable Choice*, in such a way that every element of the spaces considered exists in visual space, which is computability theory or computable analysis or effective descriptive set theory (up to effective Baire class 1), I prove that for any $k \in \mathbf{N} \setminus \{0\}$, for any computable $g \in C^\infty\left(\mathbf{R}^2, \mathbf{R}_+^*\right)$ and for any computable $f \in C^\infty\left(\mathbf{R}^2, \mathbf{R}_+^*\right)$, there exists a computable $h \in C^\infty\left(\mathbf{R}^2, \mathbf{R}_+^*\right)$ such that $h = g$ in $\overline{B}(\mathbf{0}; k)$ and $h = f$ in $\mathbf{R}^2 \setminus \overline{B}(\mathbf{0}; k + 1)$.

7. N. E. Sofronidis, *The set of continuous piecewise differentiable functions*, **Real Analysis Exchange**, Volume 31 (13), 2005/2006, pp. 13–22.

   In the framework of *ZF - Axiom of Foundation + Axiom of Countable Choice*, in such a way that every element of the spaces considered exists in visual space, which is computability theory or computable analysis or effective descriptive set theory (up to effective Baire class 1) and which is legal definition, modifying the Mazurkiewicz function, if on page 16, a, b are rational numbers and so are α, β, while T is any finite tree on $\mathbf{N}$, then F_T on pages 17, 18 is a computable function in $C^1(\mathbf{R}, \mathbf{R}_+)$.

Articles in refereed conference proceedings

1. N. E. Sofronidis, *The law of large numbers is a $\mathbf{\Pi}^0_3$-complete property*, **Proceedings of the 5$^{\mathbf{th}}$ Panhellenic Logic Symposium**, 2005, pp. 162-167.

   In the framework of *ZF - Axiom of Foundation + Axiom of Countable Choice*, in such a way that every element of the spaces considered exists in visual space, which is computability theory or computable analysis or effective descriptive set theory (up to effective Baire class 1), for any computable $\mathcal{P} : \mathbf{N} \ni \nu \mapsto \mathcal{P}(\{\nu\}) \in \mathbf{Q}^*_+$ such that $\sum_{\nu=0}^{\infty} \mathcal{P}(\{\nu\}) = 1$ in a computable way and for any computable $x \in P_3$, I construct a computable sequence $(\xi^x_n)_{n\in\mathbf{N}}$ of computable real numbers that satisfies properties (**a**), (**b**), (**c**) in a computable way, where

$$P_3 = \left\{x \in 2^{\mathbf{N}\times\mathbf{N}} : \forall m \forall^\infty n (x(m, n) = 0)\right\}.$$

Articles in arXiv.org

1. N. E. Sofronidis, *Diffeomorphisms of the closed unit disc converging to the identity*, **arXiv**, 10 July 2017.

   In the framework of *ZF - Axiom of Foundation + Axiom of Countable Choice*, in such a way that every element of the spaces considered exists in visual space, which is computability theory or computable analysis or effective descriptive set theory (up to effective Baire class 1), I prove that if $\mathcal{G}$ is the group (under composition) of computable diffeomorphisms $f : \overline{D}(0;1) \to \overline{D}(0;1)$ of the closed unit disc $\overline{D}(0;1)$ which are the identity map $id : \overline{D}(0;1) \to \overline{D}(0;1)$ on the closed unit circle and satisfy the condition $det(J(f)) > 0$, where $J(f)$ is the Jacobian matrix of f or (equivalently) the Fréchet derivative of f, then $\mathcal{G}$ equipped with the computable metric $d_{\mathcal{G}}(f, g) = \|f - g\|_\infty + \|J(f) - J(g)\|_\infty$, where f, g range over $\mathcal{G}$, is a computable metric space in which $d_{\mathcal{G}}(f_t, id) \to 0$ in a computable way as $t \to 1^+$ in a computable way, where $f_t(z) = \frac{tz}{1+(t-1)|z|}$, whenever $z \in \overline{D}(0;1)$ and $t \geq 1$.

2. N. E. Sofronidis, *On geometry and mechanics*, **arXiv**, 25 November 2017.

   In the framework of *ZF - Axiom of Foundation + Axiom of Countable Choice*, in such a way that every element of the spaces considered exists in visual space, which is computability theory or computable analysis or effective descriptive set theory (up to effective Baire class 1), using the computable Cauchy function, I construct a computable counterexample that proves that the computable tangent plane to a computable surface (which is a computable two variable function) is the limiting position of the normal vector of a computable secant plane, supplementing the corresponding work of Gauss.

3. N. E. Sofronidis, *On homeomorphisms and C^1 maps*, **arXiv**, 27 April 2018.

   In the framework of *ZF - Axiom of Foundation + Axiom of Countable Choice*, in such a way that every element of the spaces considered exists in visual space, which is computability theory or computable analysis or effective descriptive set theory (up to effective Baire class 1), I prove the following: First, if α, β are any computable points of the open unit disc $D(0;1)$ in the complex plane $\mathbf{C}$ and r, s are any positive computable real numbers such that $\overline{D}(\alpha;r) \subseteq D(0;1)$ and $\overline{D}(\beta;s) \subseteq D(0;1)$, then there exist a computable $t \in (0,1)$ and a computable homeomorphism $h : \overline{D}(0;1) \to \overline{D}(0;1)$ such that $\overline{D}(\alpha;r) \subseteq D(0;t)$, $\overline{D}(\beta;s) \subseteq D(0;t)$, $h\left[\overline{D}(\alpha;r)\right] = \overline{D}(\beta;s)$ and $h = id$ on $\overline{D}(0;1) \setminus D(0;t)$. Second, if $q \in \{2,3\}$ and $\mathbf{B}(\mathbf{0};1)$ is the open unit ball in $\mathbf{R}^q$, while for any $t > 0$, we set $f^{(t)}(\mathbf{x}) = \frac{t\mathbf{x}}{1+(t-1)\|\mathbf{x}\|}$, whenever $\mathbf{x} \in \overline{\mathbf{B}}(\mathbf{0};1)$, then $f^{(t)} \to id$ in a computable way in $C^1\left(\overline{\mathbf{B}}(\mathbf{0};1), \mathbf{R}^q\right)$ as $t \to 1^+$ in a computable way.

Student Books

1. N. E. Sofronidis, *Lectures on industrial and applied mathematics*, **Simmetria Publications**, 2014 (2023 impression).

Citations

1. N. Megiddo, Y. Xu, and B. Zhu, Editors, *Algorithmic applications in management*, Lecture Notes in Computer Science **3521**, Springer, 2005.

2. K. Prasad, *The rationality/computability trade - off in finite games*, Journal of Economic Behavior & Organization, Volume 69 (2009), pp. 17-26.