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 articles 1 and 3 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, I construct a certain continuous function $2^{(\mathbf{N}\setminus\{0\})\times(\mathbf{N}\setminus\{0\})} \ni x \mapsto (a_n^x)_{n\in\mathbf{N}} \in \mathbf{C}^{\mathbf{N}\setminus\{0\}}$ with the property that $x \in P_3$ if and only if the abscissa of absolute convergence of the Dirichlet series $\mathbf{R} \ni s \mapsto \sum_{n=1}^{\infty} \frac{a_n}{n^s} \in \mathbf{C}$ is equal to $-\infty$, where

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

   and consequently the abscissa of absolute convergence of a Dirichlet series is not continuous at $-\infty$.

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**.

   Apart from articles 2 and 5 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, I prove that the set of arbitrary production economies with 2 consumers whose preferences are continuous, 2 producers and 2 commodities, such that in the economies in question supply equals demand, is F_σ.

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, for any $\alpha \geq 0$, I construct a certain continuous function $2^{\mathbf{N}\times\mathbf{N}} \ni x \mapsto f_x \in H(\mathbf{C})$ with the property that $x \in P_3$ if and only if the order of the entire function f_x is equal to α, where $P_3 = \{x \in 2^{\mathbf{N}\times\mathbf{N}} : \forall m \forall^{\infty} n(x(m,n) = 0)\}$, and consequently the order of an entire function is a Baire class 2 function which is not continuous at every $\alpha \geq 0$. So the order of a variable entire field of velocities of a continuous medium is a Baire class 2 function which is not continuous at every

$\alpha \geq 0$. In addition, 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, for any $\alpha \geq 0$, I construct a certain continuous function $2^{\mathbf{N}\times\mathbf{N}} \ni x \mapsto (f_k^x)_{k\in\mathbf{N}} \in H(\mathbf{C})^{\mathbf{N}}$ with the property that $x \in P_5^*$ if and only if the orders of the entire functions f_0^x, f_1^x, f_2^x, ... converge to α, where $P_5^* = \left\{x \in 2^{\mathbf{N}\times\mathbf{N}} : \forall l \forall^\infty m \forall^\infty n (x(l, [m, n]) = 0)\right\}$ and $[m, n] = \frac{(m+n)^2+3m+n}{2}$, whenever $(m, n) \in \mathbf{N}^2$.

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

   First, 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, I prove that the set arbitrary exchange economies with 2 consumers whose preferences are continuous and 2 commodities, such that in the economies in question supply equals demand, is F_σ. Second, 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, I prove that the set arbitrary deterministic discrete infinite horizon macroeconomic models with a continuous one period return function and with a non-trivial closed interval in $\mathbf{R}$ for the set of state variables, such that in the models in question an optimal plan exists starting at a certain point, is F_σ.

3. N. E. Sofronidis, *Analytic non-Borel sets and vertices of differentiable curves in the plane*, **Real Analysis Exchange**, Volume 27, Number 1, 2001/2002, pp. 735-748.

   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, I prove that for any cardinal number $1 \leq n < \aleph_0$, the set of arbitrary differentiable of the class C^3 curves in the plane, such that the curves in question have at least n vertices, is F_σ. So, for any sufficiently small positive integer n, the set of projections on any road surface of arbitrary differentiable of the class C^3 orbits of the centers of gravity of arbitrary moving vehicles, such that the projections of the orbits in question have at least n vertices, is F_σ. So, for any sufficiently small positive integer n, the set of projections on the ground of arbitrary differentiable of the class C^3 orbits of the centers of gravity of arbitrary walkers or runners, such that the projections of the orbits in question have at least n vertices, is F_σ.

4. 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, I prove that every equivalence class of the asymptotic equality at a given point of the continuous real functions of a real variable is a Baire class 1 set which is dense. So every equivalence class of the asymptotic equality at a given moment of time of the projections on any road surface of the possible orbits of the center of gravity of an arbitrary moving vehicle is a Baire class 1 set which is dense. So every equivalence class of the asymptotic equality at a given moment of time of the projections on the ground of the possible orbits of the center of gravity of an arbitrary walker or runner with respect to time is a Baire class 1 set which is dense.

5. 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, 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.

6. 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, I prove that if $[0, 1]$ models the one-dimensional political spectrum, as the percentage of the private sector in the economy, in which are distributed the voters with a continuous and positive probability density function δ on $(0, 1)$, then in the strategic game $\mathcal{G}(\delta, 4)$ of Downsian competition with four political parties, 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 political parties support that ξ_1 has to be the percentage of the private sector in the economy and exactly two out of the four political parties support that ξ_3 has to be the percentage of the private sector in the economy.

7. 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, I prove that every equivalence class of the asymptotic equality at ∞ of the continuous real functions on locally compact, but not compact, perfect Polish subspaces of $\mathbf{R}^2$, is a Baire class 1 set which is dense. So, given that the escape velocity has a certain value and consequently there exists a maximum and hence a minimum sea wave length and given that any open interval of the real line is diffeomorphic to the real line, if $0 < \alpha < 1$ and Ω_α is the convex hull of $\overline{D}(0;\alpha) \cup \{1\}$, where $D(0;\alpha) = \{z \in \mathbf{C} : |z| < \alpha\}$ and $0 \leq \theta < 2\pi$, then every equivalence class of the asymptotic equality at $e^{i\theta}$ of the possible sea waves created by any moving ship, whose center of gravity is projected inside $e^{i\theta}\Omega_\alpha \setminus \left\{e^{i\theta}\right\}$, is a Baire class 1 set which is dense. In addition, 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, I prove that for any $r \in (\mathbf{N} \setminus \{0\}) \cup \{\infty\}$, every equivalence class of the asymptotic equality at ∞ of the differentiable of class C^r real functions of 2 real variables is a Baire class 1 set which is dense.

8. N. E. Sofronidis, *The equivalence relation of being of the same kind*, **Real Analysis Exchange**, Volume 33, Number 2, 2007/2008, pp. 279-284.

   In the framework of the *ZF - Axiom of Foundation + Axiom of Countable Choice*, in such a way that every element of the spaces considered exists in visual space, I prove that there exists a turbulent Polish group action whose orbit equivalence relation is a subset the equivalence relation of same kind convergence of numerical series of positive real numbers. So there exists a turbulent Polish group action whose orbit equivalence relation is a subset of the equivalence relation of same kind variable square signal waves per unit of time.

9. N. E. Sofronidis, *Topological upper limits of mixed Nash equilibria*, **Economic Theory**, Volume 34 (2008), pp. 395-399.

   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, I prove that given any 2-element sets S_1, S_2, if for any $\mathbf{u} \in \left(\mathbf{R}^{S_1 \times S_2}\right)^2$, $MNE(\mathbf{u})$ is the non-empty and compact set of mixed Nash equilibria of $(S_1, S_2, \mathbf{u})$, while $\mathbf{u}^k \to \mathbf{u}$ in $\left(\mathbf{R}^{S_1 \times S_2}\right)^2$ as $k \to \infty$, then $\limsup_{k\to\infty} MNE\left(\mathbf{u}^k\right) \subseteq MNE(\mathbf{u})$.

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^{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, for any probability measure $\mathcal{P}$ on $\mathbf{N}$ such that every elementary event has positive probability, I construct a certain continuous function $2^{\mathbf{N}\times\mathbf{N}} \ni x \mapsto (\xi^x_n)_{n\in\mathbf{N}} \in L^1(\mathbf{N}, \mathcal{P})^{\mathbf{N}}$ with the property that $x \in P_3$ if and only if the sequence of L^1 random variables $(\xi^x_n)_{n\in\mathbf{N}}$ obeys the law of large numbers, where $P_3 = \left\{x \in 2^{\mathbf{N}\times\mathbf{N}} : \forall m \forall^\infty n(x(m,n) = 0)\right\}$, and consequently the law of large numbers is not a closed property. So, since there exists a positive integer N such that every measurement in all medical sciences has at most N binary digits, for all medical sciences, measurements are in rational numbers, so for all medical sciences, every probability measure space of measurements is exactly as the ones mentioned above, so, for all measurements in all medical sciences, the law of large numbers is not a closed property and consequently, as the sample size increases, an applied treatment possibly does not converge to a real cure.

Articles in arXiv.org

1. N. E. Sofronidis, *Variational inequalities*, **arXiv**, 17 February 2015.

   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, I prove the following: If $-\infty < \alpha < \beta < \infty$ and $f \in C^3\left([\alpha,\beta]\times\mathbf{R}^2,\mathbf{R}\right)$ is bounded, while $y \in C^2([\alpha,\beta],\mathbf{R})$ solves the typical one-dimensional problem of the calculus of variations to minimize the function

   $$F(y) = \int_\alpha^\beta f(x, y(x), y'(x))\, dx,$$

   then for any $\phi \in C^2([\alpha,\beta],\mathbf{R})$ for which $\phi^{(k)}(\alpha) = \phi^{(k)}(\beta) = 0$ for every $k \in \{0,1,2\}$, it holds that

   $$\int_\alpha^\beta \left(\frac{\partial^2 f}{\partial y^2}\phi^2 - \frac{\partial^3 f}{\partial y^2 \partial y'}2\phi^3\right) dx \geq \int_\alpha^\beta \left(\frac{\partial^2 f}{\partial y \partial y'}2\phi\phi' + \frac{\partial^3 f}{\partial y \partial y'^2}2\phi^2\phi' + \frac{\partial^2 f}{\partial y'^2}\phi\phi'' + \frac{\partial^3 f}{\partial y \partial y'^2}\phi'\phi^2 + \frac{\partial^3 f}{\partial y'^3}\phi\phi'^2\right) dx.$$

   So either the above are variational inequalities of motion or the Lagrange function of motion is not C^3.

2. N. E. Sofronidis, *On continuous Polish group actions and equivalence relations*, **arXiv**, 14 March 2015.

   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, we consider the Polish space

   $$\mathbf{P} = \left\{\mathbf{x} \in \ell^1(\mathbf{R}) : (\forall n \in \mathbf{N})(\mathbf{x}(n) > 0)\right\}$$

   and the commutative Polish group $\mathbf{G} = \left\{\mathbf{g} \in (0,\infty)^{\mathbf{N}} : \lim_{n\to\infty} \mathbf{g}(n) = 1\right\}$, while we set $(\mathbf{g}\cdot\mathbf{x})(n) = \mathbf{g}(n)\mathbf{x}(n)$, whenever $\mathbf{g} \in \mathbf{G}$, $\mathbf{x} \in \mathbf{P}$ and $n \in \mathbf{N}$. So, 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, I prove the following: If we consider the Polish space

   $$\ell^1(\mathbf{C}^*) = \left\{\mathbf{x} \in \ell^1(\mathbf{C}) : (\forall n \in \mathbf{N})(\mathbf{x}(n) \neq 0)\right\}$$

and we set $\mathbf{H} = \left\{ \mathbf{h} \in (\mathbf{C}^*)^{\mathbf{N}} : \lim_{n \to \infty} \mathbf{h}(n) = 1 \right\}$, while

$$(\mathbf{h} \cdot \mathbf{x})(n) = \mathbf{h}(n)\mathbf{x}(n),$$

whenever $\mathbf{h} \in \mathbf{H}$, $\mathbf{x} \in \ell^1(\mathbf{C}^*)$ and $n \in \mathbf{N}$, then $\mathbf{H}$ is a commutative Polish group under pointwise multiplication and $\mathbf{H} \times \ell^1(\mathbf{C}^*) \ni (\mathbf{h}, \mathbf{x}) \mapsto \mathbf{h} \cdot \mathbf{x} \in \ell^1(\mathbf{C}^*)$ constitutes a continuous Polish group action each orbit of which is dense and meager, while $\mathbf{G}$ on $\mathbf{P}$ is a subaction of $\mathbf{H}$ on $\ell^1(\mathbf{C}^*)$. In addition, if $\mathbf{F} = \left\{ f \in C((0,\infty),(0,\infty)) : \lim_{x \to 0} f(x) = \lim_{x \to \infty} f(x) = 1 \right\}$, then $\mathbf{F}$ constitutes a commutative Polish group under pointwise multiplication and $\mathbf{G}^* = \left\{ \mathbf{g} \in (0,\infty)^{\mathbf{N}^*} : \lim_{n \to \infty} \mathbf{g}(n) = 1 \right\}$, which is essentially $\mathbf{G}$, is a Polish subspace and not a Polish subgroup of $\mathbf{F}$.

3. N. E. Sofronidis, *Fixed point free homeomorphisms of the complex plane*, **arXiv**, 9 August 2016.

   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, I prove that the group $H(\mathbf{C})$ of homeomorphisms of the complex plane $\mathbf{C}$ is a metric group equipped with the metric induced by uniform convergence of homeomorphisms and their inverses on compacts and the set $\{h \in H(\mathbf{C}) : (\forall z \in \mathbf{C})(h(z) \neq z)\}$ of fixed point free homeomorphisms of the complex plane is a conjugacy invariant dense G_δ subset of $H(\mathbf{C})$. In addition, 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, I prove that if F is any closed 2-cell in $\mathbf{C}$, then $\{h \in H(\mathbf{C}) : supp(h) \subseteq F\}$ is closed nowhere dense in $H(\mathbf{C})$. So for any complex plane $\mathbf{C}$ perpendicular to the esophagus O of an arbitrary human, if F is a certain closed 2-*cell* in $\mathbf{C}$ enclosing, at any time, the intersection of $\mathbf{C}$ and O, then in each swallowing the human in question does, the set of all homeomorphisms of $\mathbf{C}$ that leave $\mathbf{C} \setminus F$ invariant is closed and nowhere dense.

4. 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, I prove that if $\mathcal{G}$ is the group (under composition) of 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 metric $d_{\mathcal{G}}(f,g) = \|f-g\|_\infty + \|J(f) - J(g)\|_\infty$, where f, g range over $\mathcal{G}$, is a metric space in which $d_{\mathcal{G}}(f_t, id) \to 0$ as $t \to 1^+$, where $f_t(z) = \frac{tz}{1+(t-1)|z|}$, whenever $z \in \overline{D}(0;1)$ and $t \geq 1$.

5. 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, I prove the following: Let $\Omega \in K\left(\mathbf{R}^2\right)$ be such that $\Omega^\circ \neq \emptyset$ and let $f : \Omega \to \mathbf{R}$ be C^1, while $(x_0, y_0) \in \Omega^\circ$. If $(A, B) \in \mathbf{R}^2$ and

$$C(A,B) = \{(x,y) \in \Omega : f(x,y) - f(x_0,y_0) = A(x-x_0) + B(y-y_0)\}$$

   while $(A_n, B_n) \to \left(\frac{\partial f}{\partial x}(x_0,y_0), \frac{\partial f}{\partial y}(x_0,y_0)\right)$ in $\mathbf{R}^2$ as $n \to \infty$, then

$$\limsup_{n\to\infty} C(A_n,B_n) \subseteq C\left(\frac{\partial f}{\partial x}(x_0,y_0), \frac{\partial f}{\partial y}(x_0,y_0)\right)$$

   in $K(\Omega)$. In addition, 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, I prove the following: Let $\Omega \in K\left(\mathbf{R}^3\right)$ be such that $\Omega^\circ \neq \emptyset$ and let $f : \Omega \to \mathbf{R}$ be C^1, while $(x_0, y_0, z_0) \in \Omega^\circ$. If $(A, B, \Gamma) \in \mathbf{R}^3$ and

$$H(A,B,\Gamma) = \{(x,y,z) \in \Omega : \\ f(x,y,z) - f(x_0,y_0,z_0) = A(x-x_0) + B(y-y_0) + \Gamma(z-z_0)\}$$

   while $(A_n, B_n, \Gamma_n) \to \left(\frac{\partial f}{\partial x}(x_0,y_0,z_0), \frac{\partial f}{\partial y}(x_0,y_0,z_0), \frac{\partial f}{\partial z}(x_0,y_0,z_0)\right)$ in $\mathbf{R}^3$ as $n \to \infty$, then

$$\limsup_{n\to\infty} H(A_n,B_n,\Gamma_n) \\ \subseteq H\left(\frac{\partial f}{\partial x}(x_0,y_0,z_0), \frac{\partial f}{\partial y}(x_0,y_0,z_0), \frac{\partial f}{\partial z}(x_0,y_0,z_0)\right)$$

   in $K(\Omega)$. Moreover, 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, I prove that every C^2 space curve can be the solution of the principle of stationary action.

6. 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, I prove the following: First, if α, β are any points of the open unit disc $D(0;1)$ in the complex plane $\mathbf{C}$ and r, s are any positive real numbers such that $\overline{D}(\alpha;r) \subseteq D(0;1)$ and $\overline{D}(\beta;s) \subseteq D(0;1)$, then there exist $t \in (0,1)$ and a 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 $C^1\left(\overline{\mathbf{B}}(\mathbf{0};1), \mathbf{R}^q\right)$ as $t \to 1^+$.

Student Books

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

Citations

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

2. S. Béal, *Rationalité limitée et jeux de machines*, Revue Économique, Volume 56 (2005), pp. 1033-1063.

3. A. Marcone, *Complexity of sets and binary relations in continuum theory: a survey*, in: Set Theory. Centre de Recerca Matematica Barcelona, 2003-2004, (J. Bagaria and S. Todorcevic, eds.), Trends in Mathematics, Birkhauser, 2006, pp. 121-147.

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