

**Izidor Hafner**

Faculty of Electrical Engineering  
Ljubljana, Slovenia

**MATHEMATICAL LOGIC IN SLOVENIA 1960–2010**

**Abstract.** In the article the development of mathematical logic in Slovenia is explained. The main contributions of Slovenian logicians will be presented. Available courses and textbooks will be mentioned.

**Texts and courses available on mathematics departments**

Mathematical logic was introduced in Slovenia by Niko Prijatelj (1923–2003). In 1960 he published a book *Introduction to Mathematical Logic* [1]. This text covered propositional and predicate logic without model theory, so its content was less than usual introduction to mathematical logic. Zermelo–Fraenkel set theory was presented in his second book [2]. These texts have been used as introduction into foundation of mathematics on graduate level since 1968 on all mathematical studies in Slovenia. There were two exceptions. While preparing his new introductory books covering also model theory for predicate calculus and incompleteness of arithmetic [3–5] Prijatelj was giving 10 courses on Foundation of mathematics in interval 1982–1994. Andreja Prijatelj (1953–2002) gave similar courses on foundation of mathematics on Pedagogical Faculty in years 1997–2002. After the retirement of N. Prijatelj and premature death of A. Prijatelj mathematical logic on mathematical departments changed to contents from 1968.

The postgraduate study of mathematics in Slovenia was introduced in 1971. But only functional analysis was offered. Later some optional lectures could be chosen but not mathematical logic.

So almost all generations of Slovenian mathematicians have no formal education in mathematical logic although many of them have shown interest in it.

Some mathematicians changed to philosophy where they could get their thesis advisor or to computer science department. Of course this was not counted as mathematics. From 1980 study abroad has become possible, so many students not interested in functional analysis have gone abroad.

In 2010 new programs for mathematics include logic in its usual form (a century after *Principia mathematica*) and it is expected that the first student will receive Ph.D in mathematics with a thesis from logic.

**Researchers in mathematical logic**

In 1972 Boštjan Vilfan, whose advisor was Albert Meyer, received Ph.D from Massachusetts Institute of Technology for dissertation *The Complexity of Finite Functions*.

Vilfan was the advisor of Izidor Hafner, who after finishing postgraduate study of functional analysis got a doctorate with *thesis Theories of Lesniewski and their applications* on Faculty of electrical engineering and computing of University of Ljubljana in 1984.

Dana Scott from Carnegi Mellon [25] was advisor of Marko Petkovšek writing thesis *Finding closed-form solutions of difference equations by symbolic methods* in 1991.

In 1995 Andreja Prijatelj got Ph.D from Amsterdam University with dissertation *Investigating Bounded Contraction*. Advisors were A.S.Troelstra and J.F.A.K. van Benthem.

D. Scot was also the advisor of Andrej Bauer working on thesis *The realizability approach to computable topology and analysis* in 2000.

While Vilfan turned attention to programming and Petkovšek to computational mathematics, we are left with three logicians. Their works are mentioned in references. After finishing thesis Hafner has worked more on pedagogical aspects of logic, having an optional course of logic for computer science postgraduate students.

Andreja Prijatelj after organizing a solid basis for advance of Slovenian logic prematurely passed away and her logic pyramid collapsed in 2002.

So we are left with one promising working mathematical logician – A. Bauer.

### References

- [1] Prijatelj, Niko. *Uvod v matematično logiko*, (Knjižnica Sigma, [3]). Ljubljana: Mladinska knjiga, 1960.
- [2] Prijatelj, Niko. *Matematične strukture. 1, Množice - relacije - funkcije*, (Knjižnica Sigma, 9). Ljubljana: Mladinska knjiga, 1964.
- [3] Prijatelj, Niko. *Osnove matematične logike. Del 1, Simbolizacija*, (Knjižnica Sigma, 33). [1. izd.]. Ljubljana: Društvo matematikov, fizikov in astronomov SR Slovenije, 1982.
- [4] Prijatelj, Niko. *Osnove matematične logike. Del 2, Formalizacija*, (Matematika-fizika, 33). Ljubljana: Društvo matematikov, fizikov in astronomov Slovenije, 1992.
- [5] Prijatelj, Niko. *Osnove matematične logike. Del 3, Aplikacija*, (Matematika-fizika, 35). Ljubljana: Društvo matematikov, fizikov in astronomov Slovenije, 1994.
- [6] Hafner, Izidor. Regressive recursion. *Math. balk.*, 1976, vol. 6, pp. 75-77.
- [7] Hafner, Izidor. On some subtheory of formal arithmetic. *Glas. mat.*, 1977, vol. 12(32), pp. 229-231.
- [8] Hafner, Izidor. On proof length in the equivalential calculus. *Glas. mat.*, 1980, vol. 15(35), pp. 233-242.
- [9] Hafner, Izidor. On lower bound of the proof length in the equivalential calculus. *Glas. mat.*, 1985, vol. 20 (40), pp. 269-270.
- [10] Hafner, Izidor. The completeness theorem of equivalential calculus as prolog program. *Logic programming newsletter*, May 1987, 7, pp. 7-8.
- [11] Prijatelj, Andreja. Lambek calculus with restricted contraction and expansion. *Stud. Log.*, 1992, let. 51, vol. 1, pp. 125-143.
- [12] Prijatelj, Andreja. Reflections on "difficult" embeddings. *J. philos. logic*, 1995, year 24, pp. 71-84
- [13] Prijatelj, Andreja. Connectification for n-contraction. *Stud. Log.*, 1995, year 54, pp. 149-171.
- [14] Prijatelj, Andreja. Free algebras corresponding to multiplicative classical linear logic and some of its extensions. *Notre Dame j. form. log.*, 1996, let. 37, vol. 1, pp. 53-70.
- [15] Prijatelj, Andreja. Bounded contraction and Gentzen-style formulation of Łukasiewicz logics. *Stud. Log.*, 1996, year 57, pp. 437-456.
- [16] Prijatelj, Andreja. Free ordered algebraic structures towards proof theory. *J. symb. log.*, 2001, vol. 66, no. 2, pp. 597-608.
- [17] Bauer, Andrej, Clarke, Edmund, Zhao, Xudong. Analytica - An experiment in combining theorem proving and symbolic computation. *J. autom. reason.*, 1998, vol. 21, no. 3, pp. 295-325.
- [18] Bauer, Andrej, Birkedal, Lars. Continuous functionals of dependent types and equilogical spaces. *Lect. notes comput. sci.*, 2000, vol. 1862, pp. 202-216.
- [19] Bauer, Andrej. A relationship between equilogical spaces and Type Two Effectivity. *Math. log. q.*, 2002, vol. 48, suppl. 1, pp. 1-15.
- [20] Awodey, Steve, Bauer, Andrej. Propositions as [Types]. *J. log. comput. (Print)*, 2004, vol. 14, no. 4, pp. 447-471.
- [21] Bauer, Andrej, Simpson, Alex. Two constructive embedding-extension theorems with applications to continuity principles and to Banach-Mazur computability. *Math. log. q.*, 2004, vol. 50, no. 4/5, str. 351-3698. Bauer, Andrej, Birkedal, Lars, Scott, Dana S. Equilogical spaces. *Theor. comput. sci.*. [Print ed.], 2004, vol. 315, pp. 35-59

- [22] Awodey, Steve, Bauer, Andrej. Sheaf toposes for realizability. *Arch. math. log.*, 2008, vol. 47, no. 5, pp. 465-478.
- [23] Bauer, Andrej, Stone, Christopher A. RZ: a tool for bringing constructive and computable mathematics closer to programming practice. *J. log. comput. (Print)*, 2009, vol. 19, no. 1, pp. 17-43.
- [24] Bauer, Andrej, Taylor, Paul. The Dedekind reals in abstract Stone duality. *MSCS, Math. struct. comput. sci. (Print)*, 2009, vol. 19, iss. 4, pp. 757-838
- [25] <http://www.cs.cmu.edu/~scott/students.html>

[izidor.hafner@fe.uni-lj.si](mailto:izidor.hafner@fe.uni-lj.si)

Mathematical Logic books at E-Books Directory: files with free access on the Internet. These books are made freely available by their respective authors and publishers. Topics in Logic and Foundations by Stephen G. Simpson - The Pennsylvania State University, 2005 This is a set of lecture notes from a 15-week graduate course at the Pennsylvania State University. The course covered some topics which are important in contemporary mathematical logic and foundations but usually omitted from introductory courses. (2199 views). M. Turing - Mathematical Logic - R. Gandy, C. Yates (eds.) (Elsevier, 2001) WW.pdf (20.3MB) College Algebra 3rd ed - R. Blitzer (PTC, 2004) WW.pdf (13.7MB) College Algebra 6th ed - J. Kaufmann, K. Schwitters WW.pdf (5.5MB) College Algebra DeMystified - R. Huettenmueller (MCGraw-Hill, 2004) WW.pdf (3.8MB) College Trigonometry - W. Hart (1951) WW.pdf (18.0MB) Collocation Methods for Volterra Integral. in physics and engineering with Mathematica - F. Cap (2003) WW.djvu (1.8MB) CRC Press - Mathematics of Quantum 1. Influences of Mathematical Logic on Computer Science, by M. Davis [29], 2. On the Unusual Effectiveness of Logic in Computer Science, by J. Halpern, R. Harper, N. Immerman, P. Kolaitis, M. Vardi, and V. Vianu [60]. Its early pioneers in the 1950s and 1960s were all mathematical logicians.<sup>13</sup> While it barely registered a mention among logicians outside modal logics at the time,<sup>14</sup> automata theory quickly became a core part of computer science. It has remained so, though it has also gone through ebbs and flows of relevance (and, I may add, popularity) in different parts of the field. Mathematical logic is a subfield of mathematics exploring the applications of formal logic to mathematics. It bears close connections to metamathematics, the foundations of mathematics, and theoretical computer science. The unifying themes in mathematical logic include the study of the expressive power of formal systems and the deductive power of formal proof systems.