

# CURRICULUM VITAE

**Last name:** Vidūnas  
**First name:** Raimundas  
**Address:** Kounancho 4-7-19, Apt. 101,  
Higashinada-ku, Kobe-shi,  
Japan  
**Telephone:** +81-80-6160-6425  
**E-mail:** Raimundas.Vidunas@ua.ac.be  
**Internet webpage:** <http://www.math.kobe-u.ac.jp/~vidunas>  
**Date of birth:** January 16, 1972  
**Place of birth:** Lazdijai distr., Lithuania  
**Nationality:** Dutch  
**Spoken languages:** English, Dutch, Lithuanian, Russian, Japanese

## WORKING EXPERIENCE

**2007–2012** Assistant professor at Kobe University (Japan)  
*Grants:* JSPS research grant "Identities between Special Functions"  
*Supervision:* Two master students  
*Teaching:* Postgraduate courses on Orthogonal Polynomials  
and Zeilberger's Algorithm

**2003–2006** Post-doctoral project on Special Functions,  
Kyushu University (Fukuoka, Japan)  
*Grants:* 21st Century COE Programme, Japanese government

**2002–2003** Post-doc projects on non-commutative geometry at the  
University of Antwerp and the Free University of Brussels  
*Grants:* ESF NOG, EC TMR and Belgian Science Foundation

**1999–2001** Post-doc project "Algorithmic Methods for Special  
Functions by Computer Algebra" at the KdV Institute  
(University of Amsterdam) and at the CWI (Amsterdam)  
*Teaching:* A course on special functions

**1995–1999** PhD student, teaching assistant, University of Groningen  
*PhD thesis:* "Aspects of Algorithmic Algebra: Differential Equations  
and Splines"  
*Teaching:* I taught classes for (in total) 10 courses

**1993–1994** Participation in projects "Signature Recognition"  
and "Stereo-image Recognition"  
*Function:* Computer programmer

## EDUCATION

- 1995–1999** PhD research at the University of Groningen, Netherlands  
*Research:* Symbolic solution of differential equations, computation of two-dimensional splines  
*Supervisors:* Prof. Dr. Marius van der Put and Dr. Gert Vegter
- 1994–1995** MRI (Mathematical Research Institute) Master Class  
*Place:* University of Utrecht, The Netherlands  
*Subject:* Algebraic and Arithmetic Geometry
- 1990–1994** Mathematics Department, Vilnius University, Lithuania  
*Study:* Computer Science and Mathematics
- 1979–1990** 3rd Druskininkai Secondary School, Lithuania  
*Activities:* Successful participation in Lithuanian and Soviet Union schoolchildren Olympiads in Mathematics, Computer Science and Physics.

## REFERENCE PERSONS

- Prof. Dr. Nobuki Takayama, Kobe University,  
e-mail: [takayama@math.kobe-u.ac.jp](mailto:takayama@math.kobe-u.ac.jp).
- Prof. Dr. Masaaki Yoshida, Kyushu University (Fukuoka),  
e-mail: [myoshida@math.kyushu-u.ac.jp](mailto:myoshida@math.kyushu-u.ac.jp).
- Prof. Dr. Mark van Hoeij, Florida State University,  
e-mail: [hoeij@math.fsu.edu](mailto:hoeij@math.fsu.edu).
- Prof. Dr. Marta Mazzocco, Loughborough University,  
e-mail: [M.Mazzocco@lboro.ac.uk](mailto:M.Mazzocco@lboro.ac.uk).
- Prof. Dr. Tom H. Koornwinder, KdV Institute (Amsterdam),  
e-mail: [thk@science.uva.nl](mailto:thk@science.uva.nl).
- Prof. Dr. Wadim Zudilin, University of Newcastle (NSW, Australia),  
e-mail: [Wadim.Zudilin@newcastle.edu.au](mailto:Wadim.Zudilin@newcastle.edu.au).
- Prof. Dr. Joris van der Jeugt, University of Ghent,  
e-mail: [Joris.VanderJeugt@UGent.be](mailto:Joris.VanderJeugt@UGent.be).
- Prof. Dr. Alexander V. Kitaev, Steklov Math. Inst. (St. Petersburg),  
e-mail: [kitaev@pmdi.ras.ru](mailto:kitaev@pmdi.ras.ru).
- Dr. Nico M. Temme, CWI (Amsterdam), e-mail: [nicot@cw.nl](mailto:nicot@cw.nl).

## RESEARCH INTERESTS

My main field of interest is *Special Functions*. The last several years I worked on various identities and transformations of hypergeometric (including multivariate) functions, Heun and Painlevé functions. In particular, I classified all hypergeometric-to-hypergeometric transformations and (together with M. van Hoeij, R. Maier, G. Filipuk) most interesting Heun-to-hypergeometric transformations. Working with M. Mazzocco and A. Kitaev, I explored new transformations and algebraic solutions of the Painlevé VI equation. In addition, I started a systematic investigation of univariate specializations of Appell's and other multivariate hypergeometric functions to univariate hypergeometric or Heun functions. This led to explicit expressions for the  ${}_2F_1$  functions with a dihedral monodromy group in terms of terminating Appell's  $F_2$  functions. I look for more identities of this terminating type for other special cases of the mentioned functions.

The wide spectrum of considered special functions is unified by a few basic methods of their research, primarily transformation of related *differential equations*. In particular, algebraic hypergeometric (or Heun) functions can be instructively expressed via Klein's pullback transformations from the few standard hypergeometric equations, or via pullback transformations to a cyclic monodromy group. Other rich cases of special functions consist of elliptic integrals as hypergeometric or Heun functions, and Picard's and Hitchin's solutions of the Painlevé VI equation with an action of isogenies on generic elliptic curves.

Many of the considered transformations are realized by *Belyi coverings*. They have deep relations to arithmetic of algebraic curves, and the action of the absolute Galois group on their *dessins d'enfant* is of particular interest to Grothendieck's famous 1984 research program. I have good experience in computing Belyi coverings of degree up to 60.

I submitted a new JSPS grant proposal (for travel and other research expenses) to support publishing my assorted results in a book form. My results and the analytic setting would be better accessible if collected in a book. Yet the challenge is to write an attractive presentation of special functions from the point of view of "degenerate" explicit cases.

Other aspects of hypergeometric (and other) functions that I am interested in are: Zeilberger type summation algorithms; contiguous and recurrence relations; orthogonal polynomials; asymptotics; Picard-Fuchs equations; modular forms;  $q$ -versions of various special functions; Macdonald symmetric functions; application to the representation theory of quantum groups, or to number theory, combinatorics, random matrix theory.

In particular, I worked on *Leonard pairs* that appear in the framework of

the Askey-Wilson scheme of orthogonal polynomials, or association schemes, distance regular graphs, statistical mechanics, representation theory of certain non-commutative algebras.

I have lasting interest in non-commutative geometry, number theory, cellular automata. I attempted to do some non-standard analysis of climate and financial time series, in order to detect persistent regimes and their changes. I have a regular contacts with the geometric modelling group at my origin university in Vilnius, keeping interest in geometrically continuous splines and their curvature analysis.

### TEACHING STATEMENT

I began teaching in 1996 at the University of Groningen. Here is a sample of classes that I taught: algorithms and data structures; computer algebra; functional analysis; special functions; linear algebra and calculus for undergraduate physics students. My first assignment was computer practicum with the package **Mathematica**. This was not difficult. I remember discussing with smart students correctness of their “smart” programs. I frequently gave successful classes when students made good exercises themselves, and at the same time they were visibly satisfied that they learned something new from me. Sometimes I had language difficulties which apparently were uncomfortable to students. But even after difficult classes I have heard later appreciative remarks from the same students. The most pleasant situation is when students appreciate your teaching immediately. I am eager to have more teaching work again, in order to improve my career chances and to experience more intensive contact with students.

During my current tenure at Kobe University I taught two graduate courses (on orthogonal polynomials, and Zeilberger’s algorithm), and supervised two graduate students. In my view, the major task of a university lecturer is to teach students to use mathematics professionally. This means that the students should acquire necessary skills and understand the ways they can use their mathematical knowledge.

I have written a review of the textbook “An Introduction to Differential Equations: Order and Chaos” by Florin Diacu for the journal of the Dutch Mathematical Society. The author aims to reconcile the classical and “reform” approaches to teaching of calculus. I favour successful intuitive arguments. They give good qualitative mathematical methods and informative visualizations. On the other hand, I do not think that intuitive arguments always make the material easier and clearer. As I commented in the mentioned review, a vague definition or an ambiguous explanation may endanger clarity more than an open discussion of the particular mathematical situation.

## PUBLICATIONS

1. R. Vidūnas, *Dihedral Gauss hypergeometric functions*, Kyushu Journal of Mathematics, Vol. 65 (2011), pg. 141–167.
2. R. Vidūnas, *Transformations and invariants for dihedral Gauss hypergeometric functions*. Accepted by Kyushu Journal of Mathematics. Available at <http://arxiv.org/abs/1101.3688>.
3. R. Vidūnas, *A generalization of Clausen's identity*, Ramanujan Journal, Vol. 26 (2011), pg. 133–146.
4. R. Vidūnas, *On singular univariate specializations of bivariate hypergeometric functions*, Journal of Mathematical Analysis and Applications, Vol. 365 (2010 May), pg. 135–141.
5. R. Vidūnas, *Specialization of Appell's functions to univariate hypergeometric functions*, Journal of Mathematical Analysis and Applications, Vol. 355 (2009 July), pg. 145–163.
6. R. Vidūnas, *Algebraic transformations of Gauss hypergeometric functions*, Funkcialaj Ekvacioj, Vol. 52 (2009 August), pg. 139–180.
7. R. Vidūnas, A. V. Kitaev, *Computation of highly ramified coverings*, Mathematics of Computation, Vol. 78 (2009), pg. 2371–2395.
8. R. Vidūnas, A. V. Kitaev, *Quadratic transformations of the sixth Painlevé equation*, Mathematische Nachrichten, Vol. 280, No 16 (2007), pg. 1834–1855.
9. R. Vidūnas, *Askey-Wilson relations and Leonard pairs*, Discrete Mathematics, Vol. 308, No 4 (2008), pg. 479–495.
10. R. Vidūnas, *Normalized Leonard pairs and Askey-Wilson relations*, Linear Algebra and its Applications, Vol. 422 (2007), pg. 39–57.
11. P. Terwilliger, R. Vidūnas, *Leonard pairs and the Askey-Wilson relations*, Journal of Algebra and its Applications, Vol. 3, No. 4 (2004), pg. 411–426.
12. R. Vidūnas, *Degenerate Gauss hypergeometric functions*, Kyushu Journal of Mathematics, Vol. 61 (2007), pg. 109–135.
13. R. Vidūnas, *Expressions for values of the gamma function*, Kyushu Journal of Mathematics, Vol. 59 (2005), pg. 267–283.
14. R. Vidūnas, *Transformations of some Gauss hypergeometric functions*, Journal of Computational and Applied Mathematics, Vol. 178 (2005), pg. 473–487.

15. R. Vidūnas, *Contiguous relations of hypergeometric functions*, Journal of Computational and Applied Mathematics, Vol. 153 (2003), pg. 507–519.
16. R. Vidūnas, *A generalization of Kummer’s identity*, “Rocky Mountain Journal of Mathematics”, Vol. 32, No. 2 (2002), pg. 919–936.
17. R. Vidūnas, *Geometrically continuous octahedron*, in ”Topics in Algebraic Geometry and Geometric Modeling”, R. Goldman, R. Krasauskas (Eds.), AMS series ”Contemporary Mathematics”, No 334 (2003), pg. 37–52.
18. R. Vidūnas, N.M. Temme, *Parabolic cylinder functions: examples of error bounds for asymptotic expansions*, Analysis and applications, Vol. 1, No 3 (2003), pg. 265-288.
19. R. Vidūnas, N.M. Temme, *Symbolic evaluation of coefficients in Airy-type asymptotic expansions*, “Journal of Mathematical Analysis and Applications”, Vol. 269 (2002), pg. 317–331.
20. F. Beukers, R. van Luijk, R. Vidūnas, *A linear algebra exercise*, “Nieuw Archief voor Wiskunde” (a journal of the Dutch Mathematical Society), Series V, Vol. 3, No. 2 (2002), pg. 42–43.
21. R. Vidūnas, *Differential equations of order two with one singular point*, “Journal of Symbolic Computation”, Vol. 28, No. 4–5 (1999), pg. 495–520.
22. A. Belenkiy, R. Vidūnas, *A greatest common divisor algorithm*, “International Journal of Algebra and Computation” Vol. 8, No. 5 (1998), pg. 617–623.

### TALKS GIVEN AT CONFERENCES

- *Formulas for tetrahedral Gauss hypergeometric functions*, The 11th International Symposium on Orthogonal Polynomials, Special Functions and Applications, Madrid, August 29-September 2, 2011.
- *Transformations between Heun and hypergeometric equations*, RIMS Workshop “Analytic Number Theory – through Value Distribution and other Properties of Analytic functions”, Kyoto, October 4–8, 2010.
- *Relations between double hypergeometric sums and univariate hypergeometric functions*, The 10th International Symposium on Orthogonal Polynomials, Special Functions and Applications, Leuven (Belgium), July 20–25, 2009.

- *Investigating identities between Appell's and univariate hypergeometric functions*, Conference on the Foundations of Computational Mathematics, Hong Kong, June 16–26, 2008.
- *Simultaneously lowering operators*, RIMS Workshop “Finite Groups and Algebraic Combinatorics”, Kyoto, December 17–20, 2007.
- *Identities between Appell's and univariate hypergeometric functions*, COE Conference DMHF 2007 (Development of Dynamic Mathematics with High Functionality), Fukuoka (Japan), October 1–4, 2007.
- *Detecting persistent regimes in the North Atlantic Oscillation time series*, The IGU (International Geographic Union) 2006 Conference, Brisbane (Australia), July 3–7, 2006.
- *Quadratic transformations of Painlevé VI functions*, The 2005 Function Equations Summer School, Kurashiki (Japan), August 10–13, 2005.
- *Normalized Leonard pairs and Askey-Wilson relations*, Com2Mac 2004: Conference on Association Schemes, Codes and Designs, Busan (Korea), July 19–23, 2004.
- *Algebraic transformations of Gauss hypergeometric series*, RIMS Workshop “Computer Algebra – Design of Algorithms, Implementations and Applications”, Kyoto, December 15–18, 2003.
- *Algebraic transformations of Gauss hypergeometric series*, The 7th International Symposium on Orthogonal Polynomials, Special Functions and their Applications, Copenhagen, August 18–22, 2003.
- *A proof of Askey-Wilson relations for Leonard pairs*, The 980th AMS meeting, University of Wisconsin at Madison, October 12–13, 2002.
- *Geometrically continuous octahedron*, Workshop on Algebraic Geometry and Geometric Modelling (AGGM'02), Vilnius (Lithuania), July 29–August 2, 2002.
- *Contiguous relations of hypergeometric series*, The 6th International Symposium on Orthogonal Polynomials, Special Functions and their Applications (OPSFA'01), Rome, Italy, June 18–22, 2001.
- *A generalization of Kummer's identity*, The NATO Advanced Study Institute conference ‘Special Functions 2000: Current Perspective and Future Directions’, Arizona State University, Tempe (Arizona), May 29–June 9, 2000.
- *Summation of Non-Terminating Hypergeometric Series*, The 36th Dutch Mathematical Congress, Maastricht, April 27–28, 2000.
- *Computing Bivariate Splines*, The 5th International Symposium on Effective Methods in Algebraic Geometry (MEGA'98), University of Rennes, Saint Malo (France), June 23–28, 1998.