Ulm, January 2006

Prof. Dr. Dr. Thom Frühwirth
Programmiermethodik und Compilerbau
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Curriculum Vitae

Prof. Dr.techn. Dr.rer.nat.habil. Dipl.-Ing. Thom Frühwirth

Languages: German and English. Worked 6 years in english-speaking environments.

Working Experience and Education

Since July 2002. **Professor (C3) for Programming Methodology and Compiler Construction** at the University of Ulm, Faculty of Computer Science.

March 2002. **Declined** an offer for **professorship** in Software Engineering at Johannes Kepler University Linz and **scientific director** of the Software Competence Center Hagenberg, Austria.

July 1998. **Habilitation with second Doctorate** "A Declarative Language for Constraint Systems" at Ludwig-Maximilians-University (LMU) Munich.

1996-2002. **Assistant Professor** (C1, then C2) at the Chair of Programming and Software Engineering (Prof. Dr. M. Wirsing), Department of Computer Science, LMU Munich, Germany.

1991-96. **Researcher, then project leader** in the Constraint Reasoning group (Dr. M. Wallace) at the European Computer-Industry Research Centre (ECRC), Munich, Germany. Working language English.

April 1990. **Doctorate** in Computer Science at the Technical University of Vienna (Prof. Dr. G. Gottlob), Ph.D. thesis "Types in Logic Programming". Examination passed with distinction.

1989-90. **Visiting Scholar** for one year at the Computer Science Department (Prof. Dr. D. S. Warren), State University of New York at Stony Brook, USA. Awarded Fulbright grant and Austrian chamber of commerce grant.

1986-90. **Assistant** at the Technical University of Vienna, Department of Computer Science.

1982-86. **Master** in Computer Science at the Technical University of Vienna. Finished studies one year ahead of schedule with best possible grade.

1982-84. **System administrator** for the City of Vienna, Austria.

1981-82. **Military service** in the Austrian army.

June 1981. **Senior High School** in Tulln, Austria, passed with distinction.

Prof. Dr. Dr. Thom Frühwirth

1 Publications

This listing does not include course notes, project deliverables and internal reports. All publications have been refereed, except for some of the technical reports.

Books

[1] T. Frühwirth and S. Abdennadher, Constraint-Programmierung, Textbook, Springer Verlag, 1997.

[2] T. Frühwirth and S. Abdennadher, Essentials of Constraint Programming, Springer Verlag, 2003.

Editorships

[3] Expertensysteme - Grundlagen und Anwendungen (in German), (T. Frühwirth, G. Gottlob and W. Horn, Eds.), Reihe Angewandte Informatik, Springer Verlag, 1990.

[4] An der Schwelle zum nächsten Jahrtausend: Informatik für Menschen, Organisationen, Forschung und Lehre (in German), Proceedings Tag der Informatik (M. Wirsing and T. Frühwirth, Eds.), LMU Munich, December 1998.

[5] Special Issue on Constraint Handling Rules, Journal of Applied Artificial Intelligence (C. Holzbaur and T. Frühwirth, Eds.), Taylor & Francis, Vol. 14(4), April 2000.

[6] Special Issue on AMAST'96, Theoretical Computer Science (M. Wirsing and T. Frühwirth, Eds.), Elsevier, Vol. 239/1, May 2000.

[7] Special Issue on Constraint Agents, Constraints Journal (P. S. Eaton, T. Frühwirth and M. Tambe, Eds.), Kluwer, Vol. 7(1), January 2002.

[8] First Workshop on Constraint Handling Rules: Selected Contributions, (T. Frühwirth and M. Meister, Eds.), Ulmer Informatik-Berichte Nr. 2004-01, University of Ulm, Germany, May 2004.

[9] KI 2004: Advances in Artificial Intelligence, 27th Annual German Conference in AI (S. Biundo, T. Frühwirth and G. Palm, Eds.), Springer LNAI Vol. 3238, 2004.

[10] Poster Proceedings of the 27th Annual German Conference on Artificial Intelligence (KI 2004), (S. Biundo, T. Frühwirth and G. Palm, Eds.), Ulmer Informatik-Berichte Nr. 2004-03, University of Ulm, Germany, September 2004.

[11] 19th Workshop on (Constraint) Logic Programming W(C)LP 2005, (Armin Wolf, Thom Frühwirth, Marc Meister, Eds.), Ulmer Informatik-Berichte Nr. 2005-01, University of Ulm, February 2005.

[12] Second Workshop on Constraint Handling Rules (CHR 2005), (T. Schrijvers and T. Frühwirth, Eds.), Report CW 421, K.U. Leuven, Belgium, October 2005.

[13] Special Issue on Constraint Handling Rules, Journal on Theory and Practice of Logic Programming (S. Abdennadher, T. Frühwirth and C. Holzbaur, Eds.), Cambridge University Press, Vol 5(4 & 5), July & September 2005.

Book Chapters

[14] T. Frühwirth, Type Inference by Program Transformation and Partial Evaluation, Chapter in Meta-Programming in Logic Programming (H. Abramson and M. H. Rogers, Eds.), MIT Press, 1989.

[15] T. Frühwirth, Prolog and Meta-Interpreter, Chapter in Expertensysteme - Grundlagen und Anwendungen, (T. Frühwirth, G. Gottlob and W. Horn, Eds.), Reihe Angewandte Informatik, Springer Verlag, 1990.

[16] T. Frühwirth, E. Yardeni and E. Shapiro, Polymorphically Typed Logic Programs, Chapter in Types in Logic Programming (F. Pfenning, Ed.), MIT Press, 1992.

[17] T. Frühwirth, A. Herold, V. Küchenhoff, T. Le Provost, P. Lim, E. Monfroy and M. Wallace, Constraint Logic Programming - An Informal Introduction, Chapter in Logic Programming in Action, Springer LNCS 636, 1992.

[18] T. Frühwirth, Temporal Logic and Annotated Constraint Logic Programming, Chapter in Executable Modal and Temporal Logics (M. Fisher, Ed.), Springer LNAI 897, 1995.

[19] T. Frühwirth, Constraint Handling Rules, Chapter in Constraint Programming: Basics and Trends (A. Podelski, Ed.), Springer LNCS 910, 1995.

[20] T. Frühwirth and P. Hanschke, Terminological Reasoning with Constraint Handling Rules, Chapter in Principles and Practice of Constraint Programming (P. Van Hentenryck and V.J. Saraswat, Eds.), MIT Press, 1995.

[21] T. Frühwirth, Proving Termination of Constraint Solver Programs, Chapter in New Trends in Constraints, (K.R. Apt, A.C. Kakas, E. Monfroy and F. Rossi, Eds.), Springer LNAI 1865, May 2000.

[22] A. Raffaetta and T. Frühwirth, Semantics for Temporal Annotated Constraint Logic Programming, Chapter in Labelled Deduction (D. Basin, M. D'Agostino, D. Gabbay, S. Matthews and L. Vigano, Eds.), Applied Logic Series Vol. 17, Kluwer Academic Publishers, May 2000.

Journals

[23] T. Frühwirth, J.-R. Molwitz and P. Brisset, Planning Cordless Business Communication Systems, IEEE Expert Magazine, Special Issue on Intelligent Telecommunications, pp. 50-55, IEEE Press, February 1996.

[24] T. Frühwirth, Temporal Annotated Constraint Logic Programming, Journal of Symbolic Computation, Special Issue of Executable Temporal Logics (M. Fisher, M. Orgun and S. Kono, Eds.), Vol. 22, pp. 555-583, Academic Press, 1996.

[25] T. Frühwirth and S. Abdennadher, Der Mietspiegel im Internet, Ein Fall für Constraint-Logikprogrammierung, KI - Künstliche Intelligenz, Special Issue on Constraints (H. W. Guesgen and J. Hertzberg, Eds.), Vol. 1/97, pp. 33-36, Interdata Verlag, April 1997.

[26] T. Frühwirth, Theory and Practice of Constraint Handling Rules, Journal of Logic Programming, Special Issue on Constraint Logic Programming (P. Stuckey and K. Marriot, Eds.), Vol. 37(1-3), pp. 95-138, October 1998.

[27] S. Abdennadher, T. Frühwirth and H. Meuss, Semantics and Confluence of Constraint Simplification Rules, Constraints Journal, Special Issue on the Second International Conference on Principles and Practice of Constraint Programming (E. Freuder, Ed.), Kluwer Academic Publishers, pp. 133-165, Vol. 4(2), May 1999.

[28] T. Frühwirth and P. Brisset, Placing Base Stations in Wireless Indoor Communication Networks, IEEE Intelligent Systems Magazine, Special Issue on Practical Applications of Constraint Technology (M. Wallace and G. Freuder, Eds.), IEEE Press, Vol. 15(1), pp. 49-53, January/February 2000.

[29] C. Holzbaur and T. Frühwirth, A Prolog Constraint Handling Rules Compiler and Runtime System, Applied Artificial Intelligence, Special Issue on Constraint Handling Rules (C. Holzbaur and T. Frühwirth, Eds.), Taylor & Francis, pp. 369-388, Vol. 14(4), April 2000.

[30] T. Frühwirth and S. Abdennadher, The Munich Rent Advisor, Implementing a Success for Logic Programming, Special Issue on Logic Programming and the Internet (M. Hermenegildo, L. Naish and L. Sterling, Eds.), Journal on Theory and Practice of Logic Programming (TPLP), Cambridge University Press, pp. 303-319, Vol. 1(3), May 2001.

[31] T. Frühwirth, On the Number of Rule Applications in Constraint Programs, Declarative Programming - Selected Papers from AGP 2000, (A. Dovier, M. C. Meo, A. Omicini, Eds.), Electronic Notes in Theoretical Computer Science (ENTCS), Vol. 48, Elsevier Science Publishers, June 2001.

[32] T. Frühwirth, A. Di Pierro and H. Wiklicky, Probabilistic Constraint Handling Rules, 11th International Workshop on Functional and (Constraint) Logic Programming (WFLP 2002), Selected Papers, (Marco Comini and Moreno Falaschi, Eds.), Electronic Notes in Theoretical Computer Science (ENTCS), Vol. 76, Elsevier, 2002.

[33] T. Frühwirth, As Time Goes By II: More Automatic Complexity Analysis of Concurrent Rule Programs, QAPL'01 - Quantitative Aspects of Programming Laguages, Selected Papers, (Alessandra Di Pierro and Herbert Wiklicky, Eds.), Electronic Notes in Theoretical Computer Science (ENTCS), Vol. 59(3), Elsevier, 2002.

[34] S. Bistarelli, T. Frühwirth, M. Marte and F. Rossi, Soft Constraint Propagation and Solving in Constraint Handling Rules, Special Issue on Preferences in AI and CP, (U. Junker, ed.), Computational Intelligence, Vol. 20(2), Blackwell Publishing, May 2004.

[35] Tom Schrijvers and Thom Frühwirth, Optimal Union-Find in Constraint Handling Rules, Programming Pearl, Theory and Practice of Logic Programming, Cambridge University Press, Vol 6(1), 2006.

[36] T. Frühwirth, Constraint Systems and Solvers for Constraint Programming, Special Issue of Archives of Control Sciences (ACS) on Constraint Programming for Decision and Control, (R. Bartak, ed.), Silesian University of Technology, Gliwice, Poland, to appear 2006.

Conferences

[37] T. Frühwirth and E. Kühn, VIP-DBS: Ein integriertes logik-orientiertes Datenbank Management System, Fachtagung Die Zukunft der Informationssysteme, Linz, Austria, Springer Verlag, September 1986.

[38] T. Frühwirth, Some Thoughts on Type Inference in Prolog, 1oth Conference Computers at the University, Cavtat, Jugoslavia, June 1988.

[39] T. Frühwirth, Introducing Type Inference by Program Transformation, 8th International Conference on Computer Science (SCCC), Santiago, Chile, July 1988.

[40] T. Frühwirth, A Type Language for Prolog and Its Application to Type Inference, International Conference on Computational Intelligence (CI 88), Mailand, Italy, September 1988.

[41] T. Frühwirth, Type Inference by Program Transformation and Partial Evaluation, IEEE International Conference on Computer Languages '88, Miami Beach, USA, October 1988, IEEE Press.

[42] T. Frühwirth, A Polymorphic Type Checking System for Prolog in HiLog, 6th Israel Conference on Artificial Intelligence and Computer Vision, Ramat Gan, Israel, December 1989.

[43] T. Frühwirth, Polymorphic Type Checking with Subtypes, International Symposium on Design and Implementation of Symbolic Computation Systems (DISCO 90), Capri, Italy, Springer LNCS, April 1990.

[44] T. Frühwirth, E. Yardeni and E. Shapiro, Polymorphically Typed Logic Programs, 8th International Conference on Logic Programming (ICLP), MIT Press, June 1991.

[45] T. Frühwirth, M. Vardi, E. Shapiro, and E. Yardeni, Logic Programs as Types for Logic Programs, 6th Annual IEEE Symposium on Logic in Computer Science (LICS), Amsterdam, IEEE Press, July 1991.

[46] T. Frühwirth, Annotated Constraint Logic Programming Applied to Temporal Reasoning, Programming Language Implementation and Logic Programming (PLILP), Madrid, Spain, Springer LNCS, September 1994.

[47] S. Abdennadher, T. Frühwirth and P. Blenninger, Rent Estimates with Constraints over the Internet, Programmation en Logique et programmation par Contraintes (JFPLC'96), Clermont Ferrand, France, June 1996.

[48] S. Abdennadher, T. Frühwirth and H. Meuss, Implementing Constraint Solvers: Theory and Practice, Forum de la Recherche en Informatique'96 (FRI'96), Tunis, Tunesien, July 1996.

[49] S. Abdennadher, T. Frühwirth and H. Meuss, On Confluence of Constraint Handling Rules, Second International Conference on Principles and Practice of Constraint Programming (CP'96), Cambridge, USA, Springer LNCS, August 1996.

[50] T. Frühwirth and P. Brisset, Optimal Planning of Digital Cordless Telecommunication Systems, Third International Conference on The Practical Application of Constraint Technology (PACT97), London, England, April 1997.

[51] T. Frühwirth and S. Abdennadher, Anwendungen Constraintbasierter Programmierung, GI Informatik 97 Jahrestagung, Springer LNCS, Aachen, September 1997.

[52] S. Abdennadher and T. Frühwirth, On Completion of Constraint Handling Rules, Fourth International Conference on Principles and Practice of Constraint Programming (CP'98), Pisa, Italy, Springer LNCS, October 1998.

[53] T. Frühwirth and P. Brisset, Optimal Placement of Base Stations in Wireless Indoor Telecommunication, Winner of telecom application contest, Fourth International Conference on Principles and Practice of Constraint Programming (CP'98), Pisa, Italy, Springer LNCS, October 1998.

[54] A. Raffaetta and T. Frühwirth, Two Semantics for Temporal Annotated Constraint Logic Programming, 12th International Symposium on Languages for Intensional Programming (ISLIP'99), Athens, Greece, June 1999.

[55] T. Frühwirth, Constraint Solving with Constraint Handling Rules, 12th International Symposium on Languages for Intensional Programming (ISLIP'99), Athens, Greece, June 1999.

[56] C. Holzbaur and T. Frühwirth, Compiling Constraint Handling Rules into Prolog with Attributed Variables, International Conference on Principles and Practice of Declarative Programming (PPDP'99), Paris, France, September/October 1999.

[57] S. Abdennadher and T. Frühwirth, Operational Equivalence of CHR Programs And Constraints, 5th International Conference on Principles and Practice of Constraint Programming (CP'99), Alexandria, Virginia, USA, Springer LNCS, October 1999.

[58] A. E. M. Ciarlini and T. Frühwirth, Symbolic Execution for the Derivation of Meaningful Properties of Hybrid Systems, Poster, 16th International Conference on Logic Programming (ICLP'99), Las Cruces, New Mexico, December 1999.

[59] A. E. M. Ciarlini and T. Frühwirth, Automatic Derivation of Meaningful Experiments for Hybrid Systems, ACM SIGSIM Conference on AI, Simulation and Planning (AIS'2000), Tucson, Arizona, USA, March 2000.

[60] T. Frühwirth, Predicting Derivation Lengths in CHR Programs, Neuviemes Journees Francophones de Programmation Logique et Programmation par Contraintes (JFPLC'2000), Marseille, France, June 2000.

[61] S. Bistarelli, T. Frühwirth, M. Marte and F. Rossi, Soft Constraint Propagation and Solving in CHR, ACM Symposium on Applied Computing (SAC 2002), Madrid, Spain, March 2002.

[62] T. Frühwirth, As Time Goes By: Automatic Complexity Analysis of Simplification Rules, 8th International Conference on Principles of Knowledge Representation and Reasoning (KR2002), Toulouse, France, April 2002.

[63] S. Abdennadher and T. Frühwirth, Using Program Analysis for Integration and Optimization of Rule-based Constraint Solvers, Onziœ.Ames Journes Francophones de Programmation Logique et Programmation par Contraintes (JFPLC'2002), Nice, France, May 2002.

[64] T. Frühwirth and C. Holzbaur, Source-to-Source Transformation for a Class of Expressive Rules, Joint Conference on Declarative Programming APPIA-GULP-PRODE 2003 (AGP 2003), Reggio Calabria, Italy, September 2003.

[65] S. Abdennadher and T. Frühwirth, Integration and Optimization of Rule-based Constraint Solvers, International Symposium on Logic-based Program Synthesis and Transformation (LOPSTR'03), Uppsala, Sweden, August 2003.

[66] S. Abdennadher and T. Frühwirth, Integration and Optimization of Rule-Based Constraint Solvers, Logic Based Program Synthesis and Transformation - LOPSTR 2003, Revised Selected Papers, (M. Bruynooghe, ed.), LNCS, Springer Verlag, 2004.

[67] T. Frühwirth, Specialization of Concurrent Guarded Multi-Set Transformation Rules, Revised Selected Papers, International Symposium on Logic-based Program Synthesis and Transformation (LOPSTR 2004), (Sandro Etalle, Ed.), Springer LNCS 3573, 2005.

[68] Hariolf Betz and T. Frühwirth, A Linear-Logic Semantics for Constraint Handling Rules, 11th Conference on Principles and Practice of Constraint Programming CP 2005, LNCS 3709, Springer, October 2005.

[69] T. Frühwirth, Parallelizing Union-Find in Constraint Handling Rules Using Confluence, 21st Conference on Logic Programming ICLP 2005, LNCS 3668, Springer, October 2005.

Workshops

[70] T. Frühwirth and E. Kühn, VIP-DBS: Ein integriertes logik-orientiertes Datenbank Management System, Workshop Logisches Programmieren, GMD, St. Augustin, Germany, September 1987.

[71] T. Frühwirth, Type Inference by Program Transformation and Partial Evaluation, First Workshop on Meta-Programming in Logic Programming (META 88), Bristol, England, June 1988.

[72] T. Frühwirth, Towards a Fully Polymorphic Type System for Prolog, Workshop on Types in Logic Programming at the North American Conference on Logic Programming (NACLP 89), October 1989.

[73] T. Frühwirth, Using Meta-interpreters for Polymorphic Type Checking, 2nd Workshop on Meta-Programming in Logic (META 90), K.U. Leuven, Belgium, April 1990.

[74] T. Frühwirth, Simplification Rules, Workshop Logisches Programmieren, Goosen/Berlin, Workshop on Rewriting and Constraints, Dagstuhl, October 1991.

[75] T. Frühwirth, A. Herold, V. Küchenhoff, T. Le Provost, P. Lim, E. Monfroy and M. Wallace, The CORE Approach to Constraint Logic Programming, International Conference on Fifth Generation Computer Systems (FGCS 92), Workshop on Constraint Logic Programming, Tokyo, Japan, June 1992.

[76] T. Frühwirth, Constraint Simplification Rules, Workshop on Constraint Logic Programming at the Joint International Conference and Symposium on Logic Programming (JICSLP 92), Washington D.C., USA, November 1992.

[77] T. Frühwirth, Entailment Simplification and Constraint Constructors for User-Defined Constraints, Workshop on Constraint Logic Programming, Marseille, France, March 1993.

[78] T. Frühwirth and Ph. Hanschke, Terminological Reasoning with Constraint Handling Rules, Workshop on Principles and Practice of Constraint Programming, Newport, RI, USA, April 1993.

[79] T. Frühwirth, User-Defined Constraint Handling, Poster, International Conference on Logic Programming (ICLP 93), Budapest, Hungary, MIT Press, June 1993.

[80] T. Frühwirth, Temporal Logic and Annotated Constraint Logic Programming, Workshop on Executable Modal and Temporal Logic at IJCAI 93, Chambery, France, August 1993.

[81] T. Frühwirth, Temporal Annotated Constraint Logic Programming, Workshop on Logic and Change, Marseille, France, March 1994.

[82] T. Frühwirth, Annotating Formulas with Temporal Information, Workshop on Logic and Change at ECAI 94, Amsterdam, The Netherlands, August 1994.

[83] T. Frühwirth and S. Abdennadher, The Munich Rent Advisor, 1st Workshop on Logic Programming Tools for Internet Applications at Joint International Conference and Symposium on Logic Programming (JICSLP 96), Bonn, September 1996.

[84] C. Holzbaur and T. Frühwirth, Compiling Constraint Handling Rules (CHR), Third ERCIM/Compulog Network Workshop on Constraints, CWI Amsterdam, The Netherlands, September 1998.

[85] C. Holzbaur and T. Frühwirth, Join Evaluation Schemata for Constraint Handling Rules, 13th Workshop Logische Programmierung WLP'98, TU Vienna, Austria, September 1998.

[86] A. E. M. Ciarlini and T. Frühwirth, Using Constraint Logic Programming for Software Validation, Fifth Workshop on the German-Brazilian Bilateral Programme for Scientific and Technological Cooperation, Koenigswinter, Germany, March 1999.

[87] C. Holzbaur and T. Frühwirth, A Compiler for Constraint Handling Rules based on Partial Evaluation, 9th International Workshop on Logic-based Program Synthesis and Transformation (LOPSTR'99), Venice, Italy, September 1999.

[88] T. Frühwirth, Termination of CHR Constraint Solvers, 4th ERCIM/Compulog Workshop on Constraints, Paphos, Cyprus, October 1999.

[89] A. Raffaetta and T. Frühwirth, Spatio-Temporal Annotated Constraint Logic Programming, Third International Workshop on Practical Aspects of Declarative Languages (PADL'01), Las Vegas, USA, March 2001.

[90] T. Frühwirth, As Time Goes by: Complexity Analysis of Simplification Rules, Workshop on Quantitative Aspects of Programming Laguages (QAPL'01) at the Conference on Principles, Logics, and Implementations of high-level programming languages (PLI'01), Firenze, Italy, September 2001.

[91] T. Frühwirth, A. Di Pierro, and H. Wiklicky, Towards Probabilistic Constraint Handling Rules, Third Workshop on Rule-Based Constraint Reasoning and Programming (RCoRP'01) at CP'01 and ICLP'01, Paphos, Cyprus, December 2001.

[92] S. Bistarelli, T. Frühwirth, M. Marte and F. Rossi, Soft Constraint Propagation and Solving in CHR, Third Workshop on Rule-Based Constraint Reasoning and Programming (RCoRP'01) at CP'01 and ICLP'01, Paphos, Cyprus, December 2001.

[93] S. Bistarelli, T. Frühwirth, M. Marte and F. Rossi, CHR to model Soft Constraint Propagation and Solving, 11th International Workshop on Functional and (Constraint) Logic Programming (WFLP 2002), Grado, Italy, June 2002.

[94] T. Frühwirth, A. Di Pierro and H. Wiklicky, An Implementation of Probabilistic Constraint Handling Rules, 11th International Workshop on Functional and (Constraint) Logic Programming (WFLP 2002), Grado, Italy, June 2002.

[95] T. Schrijvers and T. Frœ.bhwirth, Analysing the CHR Implementation of Union-Find, 9th Workshop on (Constraint) Logic Programming, Ulm, Germany, February 2005.

[96] T. Schrijvers, B. Demoen, G. Duck, P. Stuckey, and T. Frhwirth, Automatic implication checking for CHR constraints, Proceedings of 6th International Workshop on Rule-Based Programming, Nara, Japan, April 2005.

[97] T. Frühwirth, Logical Rules for a Lexicographic Order Constraint Solver, Second Workshop on Constraint Handling Rules (CHR 2005), Barcelona/Sitges, Spain, October 2005.

Selected Technical Reports and Thesis'

[98] T. Frühwirth, A. Krall, E. Kühn et al., VIP - A Prolog Programming Environment, Technical Report VIP TR 1802/85/1, Technical University Vienna, Austria, January 1985.

[99] T. Frühwirth and E. Kühn, VIP-DBS: An Integrated Logic Database System Based on Prolog, Technical Report VIP TR 1802/85/4, Technical University Vienna, Austria, November 1985.

[100] T. Frühwirth, Prolog, Logik und Datenbanken, Master thesis, Institut für Praktische Informatik, Technical University Vienna, Austria, May 1986.

[101] T. Frühwirth, On Fixpoint Semantics for Types in Logic Programming Languages, Technical Report, CS at SUNY at Stony Brook, USA, July 1989.

[102] T. Frühwirth, Types in Logic Programming, Ph.D. thesis, Technical University Vienna, Institut für Angewandte Informatik, Austria, March 1990.

[103] T. Frühwirth, Constraint Logic Programming - An Overview, Technical Report E181-2, Christian Doppler Labor für Expertensysteme, Vienna, Austria, August 1990.

[104] T. Frühwirth and Ph. Hanschke, Terminological Reasoning with Constraint Handling Rules, Technical Report ECRC-94-6, ECRC Munich, February 1994.

[105] T. Frühwirth, Temporal Reasoning with Constraint Handling Rules, Technical Report ECRC-94-5, ECRC Munich, February 1994.

[106] T. Frühwirth and P. Brisset, The Constraint Handling Rules Library, Chapter in ECLiPSe 3.4 Extensions User Manual, ECRC Munich, July 1994.

[107] S. Abdennadher, T. Frühwirth, M. Marte and H. Meuss, A Confluence Test for Concurrent Constraint Programs, Technical Report PMS-FB-1995-4, Institut für Informatik, Ludwig-Maximilians-University Munich, April 1995.

[108] T. Frühwirth and P. Brisset, High-Level Implementations of Constraint Handling Rules, Technical Report ECRC-95-20, ECRC Munich, June 1995.

[109] T. Frühwirth, J.-R. Molwitz and P. Brisset, Planning Cordless Business Communication Systems, Technical Report ECRC-95-32, ECRC Munich, November 1995.

[110] S. Abdennadher, T. Frühwirth and H. Meuss, Confluent Simplification Rules, Technical Report PMS-FB-1996-7, Institut für Informatik, Ludwig-Maximilians-University Munich, January 1996.

[111] C. Holzbaur and T. Frühwirth, Constraint Handling Rules Reference Manual, Release 2.2, Österreichisches Forschungsinstitut für Artificial Intelligence, Vienna, Austria, TR-98-01, July 1998.

[112] T. Frühwirth, A Declarative Language for Constraint Systems, Habilitation, Institut für Informatik, Ludwig-Maximilians-University Munich, Germany, July 1998.

[113] C. Holzbaur and T. Frühwirth, Constraint Handling Rules Manual for Yap 4.13 Prolog, (L. Damas and V.S. Costa, Eds.), Universidade do Porto, December 2000.

[114] Tom Schrijvers and Thom Frühwirth, Implementing and Analysing Union-Find in CHR, K.U.Leuven, Department of Computer Science, Technical Report CW 389, July 2004.

[115] T. Schrijvers, B. Demoen, G. J. Duck, P. J. Stuckey and T. Frhwirth, Automatic implication checking for CHR constraint solvers, K.U.Leuven, Department of Computer Science, Report CW 402, January 2005.

2 Program Committees

Organizer, Chair

1. Organizer of the Second Workshop on Constraint Handling Rules (CHR 2005) at ICLP'05, Sitges, Spain, October 2005.
2. Co-Chair and Organizer of the 19th Workshop on (Constraint) Logic Programming (W(C)LP'05), Ulm, Germany, February 2005.
3. **Programme Co-Chair** of the German Conference on Artificial Intelligence (KI 2004), Ulm, Germany, September 2004.
4. Organizer of the First International Workshop on Constraint Handling Rules, Ulm, Germany, May 2004.
5. Co-Organizer of the Workshop on Constraint Programming and Constraint for Verification (CP+CV'04) at the European Joint Conferences on Theory and Practice of Software (ETAPS'04), Barcelona, Spain, March/April 2004.
6. Co-Organizer of the 5th Workshop on Rule-Based Constraint Reasoning and Programming (RCoRP'03) at CP2003, September 2003.
7. **Area Chair** for Constraint-based Reasoning at the 15th European Conference on Artificial Intelligence (ECAI'02), Lyon, France, July 2002.
8. Co-Organizer of the Joint Third Workshop on Rule-Based Constraint Reasoning and Programming (RCoRP'01) at the 7th International Conference on Principles and Practice of Constraint Programming (CP 2001) and 17th International Conference on Logic Programming (ICLP'01), Paphos, Cyprus, December 2001.

9. Organizer of the Second Workshop on Rule-Based Constraint Reasoning and Programming at the Sixth International Conference on Principles and Practice of Constraint Programming (CP2000), Singapore, September 2000.

10. Organizer of the Workshop on Rule-Based Constraint Reasoning and Programming at the First International Conference on Computational Logic 2000 (CL2000), London, England, July 2000.

11. Organizer of the Workshop on Constraint Reasoning for the Internet at the 3rd International Conference on Principles and Practice of Constraint Programming (CP'97), Schloss Hagenberg, Austria, November 1997.

PC Member

12. 20th Workshop on Logic Programming (WLP 2006), Vienna, Austria, February 22-24, 2006.

13. 21st International Conference on Logic Programming (ICLP'05), Sitges/Barcelona, Spain, October 2005.

14. 6th ACM-SIGPLAN International Conference on Principles and Practice of Declarative Programming (PPDP'04), Verona, Italy, August 2004.

15. Doctoral Program at the 2nd International Joint Conference on Automated Reasoning (DP at IJCAR 2004), Cork, Ireland, July 2004.

16. 5th ACM SIGPLAN Workshop on Rule-Based Programming (RULE'04), Aachen, Germany, June 2004.

17. 18th Workshop on (Constraint) Logic Programming (W(C)LP'04), Berlin, Germany, March 2004.

18. Special Track on Constraint Solving and Programming at the 17th International FLAIRS Conference, Miami Beach, USA, May 2004.

19. The IASTED International Conference on Artificial Intelligence and Applications (AIA 2004), Innsbruck, Austria, February 2004.

20. Workshop on Constraint and Logic Programming Systems (CLPS'03) at the 11th Portuguese Conference on Artificial Intelligence (EPIA'03) Beja, Portugal, December 2003.

21. 9th International Conference on Principles and Practice of Constraint Programming (CP2003), Kinsale, Ireland, September/October 2003.

22. 5th Workshop on Soft Constraints (SOFT'03) at CP2003, September 2003.

23. 2nd Workshop on Multiparadigm Constraint Programming Languages (MultiCPL'03) at CP2003, September 2003.

24. 3rd Workshop on Cooperative Solvers in Constraint Programming (Cosolv'03) at CP2003, September 2003.

25. 4th International Workshop on Rule-Based Programming (RULE'03) at the Federated Conference on Rewriting, Deduction and Programming (RDP), Valencia, Spain, June 2003.

26. Special Track on Constraint Solving and Programming, 16th International FLAIRS Conference, St. Augustine, USA, May 2003.

27. 17. WLP - Workshop Logische Programmierung, Dresden, Germany, December 2002.

28. Third ACM SIGPLAN Workshop on Rule-Based Programming (RULE'02), Pittsburgh, USA, October 2002.

29. 3rd International Workshop on the Implementation of Logics (ImpLog'02), at the 8th International Conference on Logic for Programming, Artificial Intelligence, and Reasoning (LPAR 2002), Tbilisi, Georgia, October 2002.

30. Workshop on Cooperative Solvers in Constraint Programming (COSOLV'2002), Eighth International Conference on Principles and Practice of Constraint Programming (CP 2002), Ithaca, USA, September 2002.

31. Fourth Workshop on Rule-Based Constraint Reasoning and Programming (RCoRP'02) at the Eighth International Conference on Principles and Practice of Constraint Programming (CP 2002), Ithaca, USA, September 2002.

32. 11th International Workshop on Functional and (Constraint) Logic Programming (WFLP 2002), Grado, Italy, June 2002.

33. 2nd Workshop on Implementation of Logics, La Habana, Cuba, December 2001.

34. Workshop on Cooperative Solvers in Constraint Programming (CoSolv'01), at the 7th International Conference on Principles and Practice of Constraint Programming (CP 2001), Paphos, Cyprus, December 2001.

35. Workshop on Complex Reasoning on Geographical Data (CRGD'01) at the 17th International Conference on Logic Programming (ICLP'01), Paphos, Cyprus, December 2001.

36. CP2001 (7th International Conference on Principles and Practice of Constraint Programming), Paphos, Cyprus, November/December 2001.

37. WFLP 2001 (International Workshop on Functional and Constraint Logic Programming), Kiel, Germany, September 2001.

38. PPDP 2000 (Second International ACM-SIGPLAN Conference on Principles and Practice of Declarative Programming), Montreal, Canada, September 2000.

39. WLP 2000 (15th Workshop on Logic Programming and Constraint Systems), Berlin, Germany, August 2000.

40. FroCos 2000 (Third International Workshop on Frontiers of Combining Systems), Nancy, France, March 2000.

41. WLP'99 (14th Workshop Logische Programmierung), Würzburg, Germany, January 2000.

42. CP'99 (5th International Conference on Principles and Practice of Constraint Programming), Alexandria, Virginia, USA, October 1999.

43. ISLIP'99 (Symposium on Intensional Programming Languages), Athens, Greece, June 1999.

44. DIMACS Workshop on Constraint Programming and Large Scale Discrete Optimization 1998, Rutgers, New Jersey, USA, September 1998.

45. WLP98 (Workshop Logic Programming), Vienna, Austria, September 1998.

46. AIII'97 (Artificial Intelligence in Industry Conference), High Tatra, Slovakia, April 1998.

47. IJCAI'97 Workshop on Executable Temporal and Non-Classical Logics, Nagoya, Aichi, Japan, August 1997.

48. CP'96 (2nd International Conference on Principles and Practice of Constraint Programming), Cambridge, USA, August 1996.

49. GWLP'92 (German Workshop Logic Programming), Darmstadt, October 1992.

50. META'90 (2nd Workshop on Meta-Programming in Logic Programming), Leuven, Belgium, April 1990.

3 Invited Research Visits

1. **Guest professorship** with Prof. Dr. F. Turini, University of Pisa, Italy, February/March 2002.

2. Visiting researcher with Prof. Dr. F. Turini, University of Pisa, Italy, October/November 2001.

3. **Guest professorship** with Prof. Dr. J. Crossley and Prof. Dr. Kim Marriott, Monash University Melbourne, Australia, February-April 2001.

4. Visiting researcher with Prof. Dr. F. Turini, University of Pisa, Italy, September/October 2000.

5. Visiting researcher with Prof. Dr. J. Crossley and Prof. Dr. Kim Marriott, Monash University Melbourne, Australia, March 2000.

6. Visiting researcher with Prof. Dr. K. R. Apt, CWI Amsterdam, The Netherlands, April 1999.

7. **Guest professorship** with Prof. Dr. F. Rossi, U. Montanari and G. Levi, University of Pisa, Italy, March 1999.

8. Visiting researcher with Prof. Dr. A. Haeberer, LMF-DI at Pontificia Universidade Catolica do Rio de Janeiro, Brasilia, April/May 1998.

9. Visiting researcher with Prof. Dr. E. Shapiro, Weizmann Institute of Science, Rehovot, Israel, February and June 1990.

10. Fulbright grantee with Prof. Dr. D. S. Warren, State University of New York at Stony Brook, USA, January 1989 - January 1990.

4 Invited Talks

Without talks related to accepted papers and invited courses.

1. Constraint Programming with CHR, University of Dortmund, Germany, November 2005.

2. CHR - Programming with a Chinese Horse, CP'05, Sitges/Barcelona, Spain, October 2005.

3. CHR Around the World, K.U. Leuven, Belgium, June 2005.
4. Constraint Programming with CHR, Tag der Informatik, University of Ulm, Germany, April 2005.
5. CHR Around the World, Invited Talk at W(C)LP 2005, February 2005.
6. Tutorial Reasoning with, about and for CHR, with S. Abdennadher, ACS/IEEE International Conference on Computer Systems and Applications (AICCSA'03), Tunis, Tunesia, July 2003.
7. Program Analysis for the Constraint Handling Rules Language, Universitat Politecnica de Valencia, June 2003.
8. Analysis of Constraint Handling Rules, Fraunhofer First, Berlin, February 2003.
9. Tutorial Constraint Handling Rules, International Conference on Logic Programming (ICLP'02), Copenhagen, Danmark, July 2002.
10. Constraint-Programmierung, Technical University of Graz, Austria, May 2002.
11. Description Logics as Constraint System, University of Amsterdam, The Netherlands, April 2002.
12. Reasoning with, about and for CHR, with S. Abdennadher, Fourth International Workshop on Frontiers of Combining Systems (FroCoS'2002), Santa Margherita, Italy, April 2002.
13. Automatic Complexity Analysis of Simplification Rules, LMU Munich, January 2002.
14. Constraint-Programmierung, Johannes Kepler University Linz, Austria, November 2001.
15. Constraint-Programmierung, University of Innsbruck, Austria, October 2001.
16. Tutorial Constraint Handling Rules, Joint German/Austrian Conference on Artificial Intelligence KI-2001, Vienna, Austria, September 2001.
17. Constraint-Programmierung, Otto-Friedrich-University Bamberg, June 2001.
18. Tutorial CHR in Automatic Reasoning, International Joint Conference on Automated Reasoning IJCAR 2001, Siena, Italy, June 2001.
19. Constraint-Programming with Constraint Handling Rules, University of Bozen/Bolzano, Italy, May 2001.
20. Constraint-Programmierung, Technical University of Graz, May 2001.
21. Programming in CHR, Monash University Melbourne, April 2000.
22. Constraint-Programmierung, University of Ulm, January 2001.
23. Towards Constraint-Based Test Case Generation, Technical University of Munich, December 2000.
24. Constraint Handling Rules, 2000 Joint Conference on Declarative Programming (APPIA-GULP-PRODE 2000), La Habana, Cuba, November 2000.

25. Constraint Handling Rules, Technical University of Darmstadt, October 2000.
26. Constraint Handling Rules, Technical University of Ilmenau, October 2000.
27. Analysis of CHR, University of Pisa, Italy, October 2000.
28. Tutorial Constraint Handling Rules, Sixth International Conference on Principles and Practice of Constraint Programming CP2000, Singapore, September 2000.
29. Applications of CHR, 5th ERCIM/Compulog Workshop on Constraints, Padua, Italy, June 2000.
30. Constraint-Programmierung: Grundlagen und Anwendungen, RWTH Aachen, April 2000.
31. An Overview of CHR, Macquarie University Sydney, March 2000.
32. An Overview of CHR, University of Melbourne, March 2000.
33. An Overview of CHR, Monash University Melbourne, March 2000.
34. An Overview of CHR, National University Singapore, February 2000.
35. Towards Constraint Programming for Test Case Generation, Workshop Requirements, Design, Correct Construction and Verification, FAST Munich, February 2000.
36. Constraint-Programmierung und Testfallgenerierung, Universität Oldenburg, January 2000.
37. Eine Hypermedia-Erweiterung für UML, Universität Oldenburg, January 2000.
38. Constraint Handling Rules (CHR), International Summer School on Constraints in Computational Logics, Gif-sur-Yvette, France, September 1999.
39. Constraint-Programmierung: Grundlagen und Anwendungen, Katholische Universität Eichstätt, June 1999.
40. CLP for Simulation and Testing of Hybrid Systems, CWI Amsterdam, The Netherlands, April 1999.
41. Optimal Planning of Wireless Telecommunication, SOREH GmbH, Berlin, December 1998.
42. Aktive Datenbanken, Habilitation presentation, LMU Munich, July 1998.
43. Constraint Handling Rules - Theorie und Praxis, Habilitation presentation, LMU Munich, July 1998.
44. Constraint Reasoning, Venice International University, Venice, March 1998.
45. Constraint-Programmierung, GMD-FIRST, Berlin, December 1997.
46. Constraint Handling Rules Demonstration, CP-Konferenz, Linz, Austria, October 1997.
47. Constraint-Programmierung, Workshop Logisches Programmieren, Munich, September 1997.

48. Constraint Handling Rules Demonstration, KI-Konferenz, Freiburg, September 1997.

49. Constraint Handling Rules - Theorie und Praxis, Kolloqiumsvortrag, LMU Munich, July 1997.

50. Why the Internet needs Constraints, WWW6 Workshop Logic Programming and the Web, Santa Clara, USA, April 1997.

51. Constraints go Internet - Beyond the Munich Rent Advisor, School of Informatics, City University, London, England, December 1996.

52. Constraints go Internet - Beyond the Munich Rent Advisor, Workshop Logic Programming and the Internet, Imperial College, London, England, December 1996.

53. Confluence of Constraint Handling Rules, Imperial College, London, England, August 1996.

54. Constraint Handling Rules - An Introduction, LMU Munich, June 1996.

55. Constraint Handling Rules and Confluence, Technical University Munich, January 1996.

56. Constraint Handling Rules and their Applications, CWI Amsterdam, The Netherlands, December 1995.

57. Constraint Handling Rules by Example, DFKI Saarbrücken, May 1995.

58. Constraint Handling Rules, Workshop Logisches Programmieren, University Zurich, Switzerland, October 1994.

59. Constraint Reasoning, Ludwig-Maximilians-University (LMU) Munich, July 1994.

60. Constraint Handling Rules, Spring School on Constraints, Chatillon/Seine, France, May 1994.

61. Constraint Handling Rules, RISC Linz, Austria, March 1994.

62. Temporal Reasoning with Constraint Handling Rules, University Zurich, Switzerland, May 1993.

63. Constraint Handling Rules, LMU Munich, May 1993.

64. Constraint Handling Rules, Deutsches Forschungsinstitut für Künstliche Intelligenz (DFKI), Kaiserslautern, April 1993.

65. Constraint Handling Rules, Centrum für Informations- und Spragchverarbeitung (CIS) Munich, March 1993.

66. Types in Logic Programming, University Zurich, Switzerland, November 1990.

67. Constraint Logic Programming, Technical University Vienna, Austria, May 1990.

68. Type Inference by Program Transformation and Partial Evaluation, University Padua, Italy, September 1988.

5 Research Interests

Programming Languages: High-level programming languages with constraint extensions; innovative algorithms to solve combinatorial problems; semantics, analysis and compiler construction for declarative programming languages.

Software Engineering: Specification, simulation and verification of hybrid systems; semantics and analysis of diagrammatic notations like UML.

Logic: Executable logics, modal logics, temporal and spatial reasoning.

6 Project Funding

This listing does not include grants due to guest professorships and other visiting positions. Results of projects include publications and software tools.

Project Applicant and Project Manager

1. **GLOB-CON DFG** *Project FR 1390/1-1, Rule-Based Propagation of Global Constraints, März 2006-2008. Project partner is Dr. Sebastian Brand, Melbourne University, Australia.* The project is concerned with the formally correct and efficiently execu table specification of constraint propagation for complex, global constraints by mean s of rules.
   A constraint satisfaction problem consists of a set of constraints which must be satisfied by every solution. Problems of this type, including NP-complete ones, can be solved well by problem simplification methods – constraint propagation – combined with search. Notably constraint-specific propagation methods can cause huge reductions of the search space at low cost, drastically reducing the solving time in turn. Specification as well as correct implementation of such methods requires substantial expertise, however.
   Rules have proved to be a useful formalism for the description of the propagation of primitive, simple constraints. Appropriate rule-based languages, notably Constraint Handling Rules, and corresponding implementations exist in which constraint propagation procedures can immediately be executed. Several methods for generating propagation rules automatically from declarative definitions of primitive constraints have been developed in the last years. The purpose of this project is to investigate the specification of the propagation of global constraints by rules, and the automatic generation of rule-based constraint propagation mechanisms for such constraints.
   This project proposal pursues the classical ideal of generating practical programs from formal specifications.

2. **ROARS** *DAAD Probral and CAPES Project, Reuse-Oriented Automated Reasoning Software, March 2006-2008. Project partners are Prof. Dr. Jacques Robin, Universidade Federal do Pernambuco (CInUFPE), Recife, Brazil, and Prof. Dr. Colin Atkinson, University of Mannheim, Germany, and Dr. Armin Wolf, Fraunhofer FIRST, Berlin, Germany.* The project aims to create the first inter-institutional research group worldwide to investigate the cross-fertilization between reuse-oriented software engineering and application-embedded automated reasoning based on constraints and rules. Main issues are the meta-model and formal logic semantics of a hybrid object-oriented, rule-based constraint language to mediate between UML models and

Java or C implementations to create reusable and extensible rule-based AR components for deduction, abduction, belief revision, inheritance, finite domain constraint solving and their seamless integration.

3. **JaCK** IB-BMBF/SCyT Projekt ARG 030/98 INF: *Java Constraint Kit*, 2000-2002. Project partners are FAST Munich, SIEMENS Munich and Instituto de Sistemas, University Tandil, Argentina. The main goal is to develop a Java-based software tool for solving combinatorial, optimization and planning problems using constraint technology. We implemented a constraint logic programming kit in the internet programming language Java. The library consists of a high-level language for writing constraint solvers, a generic search engine and a tool to visualize the simplification and propagation of constraints.

4. **FLPC DFG** Wi 841/4-1: *Functional Logic Programming with Constraints*, 1996-2002. The goal of the project is the semantically well-founded integration of functional, logic and constraint-based programming with graphical user interfaces, the implementation of a prototype language, the use and validation of the language in application studies in diagrammatic reasoning and finally the development of a programming methodology.

5. **ZEITRAUM** DAAD Projekt 314-VIGONI-DR: *Spatio-temporal Reasoning in Deductive Environments*, 2000-2001. The project together with the University of Pisa aims at the development of new techniques to support spatio-temporal reasoning in databases, in particular geographic information systems (GIS), on the basis of constraint logics and constraint databases. The TACLP approach of T. Frühwirth was extended by spatial aspects and integrated into deductive data models. In this way, we improved the application-oriented representation of spatio-temporal relationships and the user-friendly integration and interaction of heterogeneous data models and information sources for problem solving.

6. **DExVal** IB-BMBF/CNPQ Projekt BRA INF ARTS: *Formal Derivation of Meaningful Validation Experiments*, 1998-2000. Together with BMW AG Munich and the LMF-DI department of PUC-Rio (Pontificia Universidade Catolica Do Rio de Janeiro) we work on a tool to derive validation and testing tasks of software derived from formal specifications. The basis of our approach is the abstract execution of hybrid systems (including statecharts) in a constraint logic programming language.

7. **Fulbright grant** and **Austrian chamber of commerce grant**, Ph.D. grants: *Types in Logic Programming*, 1989-90. Scholarship at Computer Science Department, State University of New York at Stony Brook, USA.

Project Collaborator

8. **Knowledge Master**, *Course on Knowledge Management*, 1998-2000. Development and deployment of the course together with SIEMENS SQT and three institutes of LMU Munich (Psychology, Economics, Computer Science).

9. **LAC** ESPRIT #7035, *Logic and Change*, 1994-96. Research in non-monotonicity and temporal change in logics and its application in programming languages.

10. **CHIC** ESPRIT #5291, *Constraint Handling in Industry and Commerce*, 1991-95. Development of a programming methodology for constraint languages and its application in industry.

11. **IDEA** ESPRIT #6333, *Intelligent Database Environment for Advanced Applications*, 1995. Development of an object-oriented deductive database system.

12. **EQUATOR** ESPRIT #2409, *Environment for Qualitative Temporal Reasoning*, 1992-93. Development and application of temporal reasoning to air traffic control and urban traffic control.

13. **VIP-DBS** Austrian National Bank Grant #2791, *A Deductive Database Management System* (in German), 1984-86. Development of a deductive database system at the Technical University of Vienna.

7 Selected Software

This listing only includes software that is not part of a funded project.

CHR - The Constraint Handling Rules Language

CHR is my declarative, very high-level, concurrent programming language for the specification and implementation of constraint solvers and constraint programs. In CHR, rules define how constraints are simplified and how constraints propagate new constraints. The CHR language supports rapid prototyping and executable specification of extensions, special cases and combinations of constraint solvers. Theoretical work deals with semantics, analysis and transformation of CHR programs.

CHR has been implemented in more than 10 programming languages, including Prolog and Java. CHR is used by more than 60 projects worldwide. A special issue of the Journal of Applied Artificial Intelligence on CHR appeared in April 2000, a special issue of the Journal on Theory and Practice of Logic Programming appeared in September 2005.

POPULAR - Optimal Planning of Wireless Communication

The versatility of CHR has been shown in a real-life application for SIEMENS involving geometric reasoning to find the optimal placement of senders for wireless portable devices (e.g. phones). Given a blue-print of the building and information about the materials used for walls and ceilings, POPULAR computes the minimal number of transmitters and their location by simulation and subsequent constraint-based optimization.

This tool was regarded as one of the most innovative applications in telecommunications by IEEE Expert Magazine. In 1998, POPULAR won the Telecom application contest of Telecom Italia at CP'98, the annual conference on constraint programming.

MRA - The Munich Rent Advisor

This real-life application brings constraints to the internet. It is a small expert system that allows one to calculate the typical rent of a flat in Munich based on your input to a questionnaire.

The Munich Rent Advisor (MRA) won the prize for best application at JFPLC, Clermont Ferrand, France, 1996. The MRA was shown at the SYSTEMS 96 and SYSTEMS 97 Computer Shows in Munich, and featured in several newspaper articles and AI Watch, UK.

8 Teaching Experience

Lectures at the University of Ulm

Lecture and Lab Course on Constraint Programming, 4+2 weekly hours, WS 02/03, WS 03/04, WS 04/05, WS 05/06.

Undergraduate Seminar Logic Programming, 2 weekly hours, with colleagues, WS 04/05, WS 05/06.

Lecture Rule-Based Formalisms, 2 weekly hours, WS 05/06.

Lab Course in Constraint Programming, 4 weekly hours, with one colleague, SS 03, SS 04, SS 05.

Lab Course SrcML Source Code Representation, 4 weekly hours, with one colleague, SS 05.

Lecture Program Analysis, 2 weekly hours, SS 05.

Seminar Rule-Based Systems 2 weekly hours, with colleagues, WS 04/05.

Undergraduate Seminar Mathematical Foundations of Computer Science, 2 weekly hours, with colleagues, SS 04.

Seminar Translation of Novel Programming Language Concepts, 2 weekly hours, with colleagues, SS 04.

Lecture Practical Computer Science I (about 250 students), 4+2 weekly hours, with colleagues, WS 03/04.

Seminar on User Guidance and GUI Specification, 2 weekly hours, with colleagues, SS 03.

Undergraduate Seminar on Functional Programming, 2 weekly hours, with colleagues, SS 03.

Lectures at LMU Munich

Lecture and Lab Course on Constraint Programming, 4+2 weekly hours, with one colleague, SS 97 to SS 02.

Lecture and Lab Course on Programming and Software Engineering (about 350 students), 2+3 weekly hours, with four TA's, WS 97/98, WS 99/00 and WS 01/02.

Lab Course on Constraint Reasoning in Java, 4 weekly hours, with one colleague, WS 99/00 and WS 01/02.

Lab Course on Programming in Java (100 students), 4 weekly hours, with colleagues, WS 00/01.

Seminar on Constraint Programming, 2 weekly hours, with one colleague, WS 99/00.

Seminar on Constraints, 2 weekly hours, with colleagues, WS 96/97 to SS 99.

Lecture on Temporal and Spatial Reasoning, 2 weekly hours, WS 98/99.

Lab Course on Time-Tabling and Room-Planning, 4 weekly hours, with one colleague, WS 98/99.

Lab Course in Programming, 4 weekly hours, with two TA's, WS 96/97.

Lab Course on Introduction to Computer Science II, 2 weekly hours, with three TA's, SS 96.

Lecture and Lab Course on Constraint Reasoning, 2+2 weekly hours, with one TA, WS 94/95.

Courses outside Germany

In English

Lecture Constraint Programming and Reasoning, 5*3 hours, Universita Ca' Foscari di Venezia, Italy, May 2004.

Lecture Constraint Programing and Reasoning, 10*2 hours, University of Pisa, Italy, February/March 2002.

Course Constraint Programming, 5*2 hours, International Summer School in Computational Logic, Acquafredda di Maratea, Italy, September 2000.

Lecture Constraint Programing and Reasoning, 10*2 hours, University of Pisa, Italy, March 1999.

Constraint Programming Course, 2*4 hours, LMF-DI at Pontificia Universidade Catolica Do Rio de Janeiro, Brazil, April/May 1998.

Course "Constraint Reasoning", 7*2 hours, European Summer School in Logic, Language and Information (ESSLLI'97), Aix-en-Provence, France, August 1997.

Compact course "Constraint Reasoning", 8 hours, 10th Biennial Conference on AI and Cognitive Science (AISB-95), Sheffield, England, April 1995.

In German

Lecture on Expert Systems, with colleagues, 2 weekly hours, WS 88/89 and WS 89/90, Technical University Vienna.

Seminar on Logic Programming, with colleagues, 2 weekly hours, SS 86 and SS 87, Technical University Vienna.

Course instructor in Computer Science for managers and High School representatives, Salzburg and Vienna, Austria, February 1985 and February 1986.

Computer Science teacher with colleagues at Senior High School, Tulln, Austria, SS 84.

Supervised Ph.D. Thesis'

Spatio-Temporal Knowledge Bases in a Constraint Logic Programming Framework with Multiple Theories, Alessandra Raffaetta, December 1999, University of Pisa. Passed with distinction.

Adaptive Constraintverarbeitung mit Constraint Handling Rules, Armin Wolf, May 1999, Technical University Berlin. GMD-Award for best dissertation 1999.

Implementierung von Constraintlösern: Theorie und Praxis, S. Abdennadher, Dissertation, May 1998, LMU Munich. Passed with distinction.

Supervised Master Thesis'

A Linear Logic Semantics for CHR, H. Betz, October 2004, University of Ulm.

Ressourcenplanung für Verbrauchszählerverwaltung, A. von Drach, April 2002, LMU Munich.

A Generic Search Engine for a Java Constraint Kit, E. Krämer, July 2001, LMU Munich.

Eine CHR-Bibliothek für Java, M. Schmauss, December 1999, LMU Munich.

Konfluenz von Constraint Handling Rules, H. Meuss, July 1996, LMU Munich.

Typmetainterpreter in Prolog, W. M. Felser, September 1989, Technical University Vienna.

Die Synthese der funktionalen und logischen Programmierung, D. Czedik-Eysenberg, November 1988, Technical University Vienna.

Meta-Interpreter, B. J. Knaus, April 1988, Technical University Vienna.

9 Additional Professional Activities

Referee for national and international

Conferences such as LICS, IJCAI, POPL, ECAI, JICSLP, ICLP, CADE, CP, PPDP, AMAST, CSL, VLFM, MFCS, WRLA, FOSSACS, EPIA, FLAIRS, SAC, FSTTCS, AIA, IJCAR, LPAR,

Journals and Book Series such as TCS, AI, IEEE TSE, Constraints, JLP, TPLP, ENTCS, ACM TOPLAS, AMAI, JFP, Information and Computation, Fundamenta Informaticae; LNAI, LNCS, CP Handbook,

Research funding agencies in Germany, Italy, The Netherlands, Switzerland, USA, Ireland, England, France, and

Ph.D. thesis' in Germany, Belgium, Italy, Portugal, Australia

in the areas of Programming Languages, Logic and Software Engineering.

Teacher at the graduate school on Logic in CS, LMU Munich, 1999-2002.

CP'98 Telecom Application Award for a tool for optimal sender placement, 1998.

Main author of first textbook on constraint programming, 1997.

Founder of the constraint working group at LMU Munich, 1997.

Prize for best application for the Munich Rent Advisor on the Internet at JFPLC conference, Clermont Ferrand, France, 1996.

Co-founder and vice president of the German chapter of the Association of Logic Programming, 1992-1993.

10 Selected Publications

These publications (except books) are available on the internet via my home page
`http://www.informatik.uni-ulm.de/pm/mitarbeiter/fruehwirth/`

1. *T. Frühwirth and S. Abdennadher, Essentials of Constraint Programming, Springer, 2003.*
   The book is a short, concise and complete presentation of constraint programming and reasoning. The use of constraints had its scientific and commercial breakthrough in the 1990s. Programming with constraints makes it possible to model and solve problems with uncertain, incomplete information and combinatorial problems, as they are abundant in industry and commerce, such as scheduling, planning, transportation, resource allocation, layout, design and analysis. The theoretically well-founded presentation includes application examples from real life. It introduces the common classes of constraint programming languages and constraint systems in a uniform way. Constraint solving algorithms are specified and implemented in the constraint handling rules language (CHR).

2. *T. Frühwirth, As Time Goes By: Automatic Complexity Analysis of Simplification Rules, 8th International Conference on Principles of Knowledge Representation and Reasoning (KR2002), Toulouse, France, April 2002.*
   From a suitable termination order, called a tight ranking, we can automatically compute the worst-case time complexity of a CHR constraint simplification rule program from its program text: We combine the worst-case derivation length of a query predicted from its ranking with a worst-case estimate of the number and cost of rule application attempts and the cost of rule applications to obtain the desired meta-theorem.

3. *A. Raffaetta and T. Frühwirth, Semantics for Temporal Annotated Constraint Logic Programming, in Labelled Deduction (D. Basin, M. D'Agostino, D. Gabbay, S. Matthews and L. Vigano, Eds.), Applied Logic Series Vol. 17:215-243, Kluwer Academic Publishers, May 2000.*
   On the semantics of a powerful class of temporal programming languages for representing and reasoning about time. The class is conceptually simple while allowing for different models of time. Formulas can be labeled with temporal information using annotations.

4. *C. Holzbaur and T. Frühwirth, A Prolog Constraint Handling Rules Compiler and Runtime System, Applied Artificial Intelligence, Special Issue on Constraint Handling Rules (C. Holzbaur and T. Frühwirth, Eds.), Taylor & Francis, Vol. 14(4):369-388, April 2000.* The paper describes an optimizing compiler and runtime system for implementing the CHR language. The central part of the system is a small number of templates that are defined by definite clause grammar rules and that generate compact code when subsequently partially evaluated.

5. *T. Frühwirth and P. Brisset, Optimal Placement of Base Stations in Wireless Indoor Communication Networks, IEEE Intelligent Systems Magazine, Special Issue on Practical Applications of Constraint Technology (M. Wallace and G. Freuder, Eds.), IEEE Press, Vol. 15(1):49-53, January/February 2000.*
   The goal is to find the optimal placement of senders for wireless portable devices such that a building or company site can be completly covered. Given a blue-print of the building and information about the materials used for walls and ceilings, the planning tool POPULAR computes the minimal number of

transmitters and their location by simulation and subsequent constraint-based optimization.

6. *S. Abdennadher, T. Frühwirth and H. Meuss, Semantics and Confluence of Constraint Simplification Rules, Constraint Journal, Special Issue on the Second International Conference on Principles and Practice of Constraint Programming (E. Freuder, Ed.), Kluwer Academic Publishers, Vol. 4(2):133-165, May 1999.*
   Theoretical investigation of declarative and operational semantics of a concurrent constraint programming language, including soundness and completeness results and a decidable, necessary and sufficient condition for confluence of computations in that language.

7. *T. Frühwirth, Theory and Practice of Constraint Handling Rules, Special Issue on Constraint Logic Programming (P. Stuckey and K. Marriot, Eds.), Journal of Logic Programming, Vol. 37(1-3):95-138, October 1998.*
   Survey paper on a rule-based declarative language for specifying, implementing and analysing constraint systems, which has been used in over 60 projects worldwide.

8. *T. Frühwirth and S. Abdennadher, Constraint-Programmierung, Textbook, Springer Verlag, 1997.*
   The first textbook on constraint programming, its principles and applications.

9. *T. Frühwirth, Temporal Annotated Constraint Logic Programming, Journal of Symbolic Computation, Special Issue Executable Temporal Logics (M. Fisher, M. Orgun and S. Kono, Eds.), Vol. 22:555-583, Academic Press, 1996.*
   Journal paper on a powerful class of temporal logics with their associated programming languages and their implementation schemes using either an interpreter or a compiler. The class is conceptually simple while allowing for different models of time. Formulas can be labeled with temporal information using annotations.

10. *T. Frühwirth, M. Vardi, E. Shapiro, and E. Yardeni, Logic Programs as Types for Logic Programs, 6th Annual IEEE Symposium on Logic in Computer Science (LICS), (G. Kahn, Ed.), pp. 300-309, Amsterdam, July 1991.*
    An often cited, now classical paper on type theory for declarative programming languages. The paper became also a basic reference for set constraints. Descriptive type systems let the programmer write programs without having to define or mention types. We consider types that are conservative approximations to the success set of the program predicates. We propose the use of logic programs to infer and describe types. This approach unifies the denotational and operational approaches to descriptive type systems and is simpler and more natural than previous approaches. A proper class of unary-predicate programs is shown to be expressive enough to express several notions of types. We use an analogy with 2-way automata and a correspondence with alternating algorithms to obtain a complexity characterization of type inference and type checking.