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Integration of categorical frameworks: Rule-based refinement and hierarchical composition for components. (English) [Zbl 1147.68055](#)

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Summary: The integration of two important categorical frameworks-namely adhesive High-Level Replacement (HLR) systems and the generic component concept-yields a categorical approach to component transformation and refinement. The generic component concept is shown to be an adhesive HLR category, so rules and transformations as well as the corresponding results are available. Moreover, the compatibility with the hierarchical component composition is provided. The extension to rule-based refinement requires additional property-preserving morphisms and yields property-preserving rules and transformations, i.e. refinements where compatibility with the hierarchical component composition again is achieved. The categorical framework is instantiated to typed Algebraic High-Level (AHL) nets and illustrated with an example of AHL net components.

MSC:

[68Q85](#) Models and methods for concurrent and distributed computing (process algebras, bisimulation, transition nets, etc.)

[68Q42](#) Grammars and rewriting systems

[18A99](#) General theory of categories and functors

Keywords:

[Category theory](#); [Software component](#); [Transformation](#); [Rule-based refinement](#)

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References:

- [1] de Alfaro, L., Henzinger, T.A.: Interface automata. In: ESEC/FSE 01: Proceedings of the Joint 8th European Software Engineering Conference and 9th ACM SIGSOFT International Symposium on the Foundations of Software Engineering (2001) · [Zbl 1050.68518](#)
- [2] Cornelius, F., Baldamus, M., Ehrig, H., Orejas, F.: Abstract and behaviour module specifications. *Math. Structures Comput. Sci.* 9, 21–62 (1999) · [Zbl 0923.68089](#) · [doi:10.1017/S0960129598002606](#)
- [3] Corradini, A., Montanari, U., Rossi, F., Ehrig, H., Heckel, R., Löwe, M.: Algebraic approaches to graph transformation I : basic concepts and double pushout approach. In: Rozenberg G. (ed.) *Handbook of Graph Grammars and Computing by Graph Transformation*, vol. 1: Foundations, Chap 3. World Scientific (1997)
- [4] Ehrig, H., Braatz, B., Klein, M., Orejas, F., Pérez, S., Pino, E.: Object-oriented connector-component architectures. In: Proc. FESCA '05, *Electronic Notes of TCS*, vol. 141(3), pp. 123–151 (2005)
- [5] Ehrig, H., Baldamus, M., Orejas, F.: New concepts for amalgamation and extension in the framework of specification logics. In: Proc. WADT-COMPASS-Workshop, 1991, pp. 199–221. Springer LNCS 655 (1992) · [Zbl 0744.68099](#)
- [6] Ehrig, H., Ehrig, K., Prange, U., Taentzer, G.: *Fundamentals of Algebraic Graph Transformation*. EATCS Monographs in Theoretical Computer Science. Springer (2006) · [Zbl 1095.68047](#)
- [7] Ehrig, H., Habel, A., Kreowski, H.-J., Parisi-Presicce, F.: Parallelism and concurrency in high-level replacement systems. *Math. Structures Comput. Sci.* 1, 361–404 (1991) · [Zbl 0749.68045](#) · [doi:10.1017/S0960129500001353](#)
- [8] Ehrig, H., Habel, A., Padberg, J., Prange, U.: Adhesive high-level replacement categories and systems. In: Parisi-Presicce F., Bottoni P., Engels G. (eds.) In: Proc. 2nd Int. Conference on Graph Transformation (ICGT'04), Springer LNCS, vol. 3256 pp. 144–160. (2004) · [Zbl 1116.68480](#)
- [9] Ehrig, H., Mahr, B.: *Fundamentals of algebraic specification 2: module specifications and constraints*, vol. 21 of EATCS Monographs on Theoretical Computer Science. Springer, Berlin (1990) · [Zbl 0759.68013](#)
- [10] Ehrig, H., Orejas, F., Braatz, B., Klein, M., Piirainen, M.: A generic component concept for system modeling. In: Proc. FASE 2002: Formal Aspects of Software Engineering, Springer LNCS, vol. 2306, pp. 32–48. Springer (2002) · [Zbl 1059.68543](#)
- [11] Ehrig, H., Orejas, F., Braatz, B., Klein, M., Piirainen, M.: A component framework for system modeling based on high-level replacement systems. *Softw. Syst. Model.* 3, 114–134 (2004) · [Zbl 02243155](#) · [doi:10.1007/s10270-003-0043-9](#)
- [12] Ehrig, H., Padberg, J., Braatz, B., Klein, M., Orejas, F., Pérez, S., Pino, E.: A generic framework for connector architectures

- based on components and transformations. In : Proc. FESCA'04, Electronic Notes of TCS, vol. 108, pp. 53–67 (2004)
- [13] Große-Rhode, M., Parisi Presicce, F., Simeoni, M.: Refinements and modules for typed graph transformation systems. In: Fiadeiro J.L. (ed.) Workshop on Algebraic Development Techniques (WADT'98), at ETAPS'98, Lisbon, April 1998, pp. 137–151. Springer LNCS 1589 (1999) · [Zbl 0961.68034](#)
 - [14] Gruhn, V., Thiel, A.: *Komponentenmodelle: DCOM, JavaBeans, EnterpriseJavaBeans, CORBA*. Addison-Wesley, 2000.
 - [15] Jiménez, R.M., Orejas, F.: An algebraic framework for higher-order modules. In: FM'99 - Formal Methods, World Congress on Formal Methods in the Development of Computing Systems, Springer LNCS, vol. 1709, pp. 1778–1797 (1999) · [Zbl 0953.68097](#)
 - [16] Klein, M.: Transformation-based component architectures general framework, instantiations and case study. Ph.D. thesis, Technische Universität Berlin, Fak. IV (2006)
 - [17] Klein, M., Padberg, J., Orejas, F.: Towards multiple access in generic component architectures. In: Proc. FESCA '06, Electronic Notes of TCS, vol. 176(2), pp. 25–45 (2006)
 - [18] Lack, S., Sobociński, P.: Adhesive categories. In: Proc. FOSSACS 2004, Springer LNCS, vol. 2987, pp. 273–288 (2004) · [Zbl 1126.68447](#)
 - [19] Mann, S., Borusan, B., Ehrig, H., Große-Rhode, M., Mackenthun, R., Sünbül, A., Weber, H.: Towards a component concept for continuous software engineering. Technical Report 55/00, FhG-ISSIT (2000)
 - [20] Orejas, F., Pérez, S.: Towards architectural connectors for uml. In: Kreowski, U., Montanari, H.J., Orejas, F., Rozenberg, G., Taentzer, G. (eds.) Formal Methods in Software and Systems Modeling, Springer LNCS, vol. 3393, pp. 352–369 (2005) · [Zbl 1075.68569](#)
 - [21] Padberg, J.: Categorical approach to horizontal structuring and refinement of high-level replacement systems. Appl. Categ. Structures 7(4), 371–403, December (1999) · [Zbl 0941.18001](#) · [doi:10.1023/A:1008695316594](#)
 - [22] Padberg, J.: Petri net modules. J. Integr. Des. Process. Technol. 6(4), 121–137 (2002)
 - [23] Padberg, J.: Integration of the generic component concepts for system modeling with adhesive HLR systems. Bulletin of the EATCS, vol. 87, pp. 138–155 (2005)
 - [24] Padberg, J.: Specification and rule-based refinement of software-components. Habilitation Thesis, Technische Universität Berlin (2005)
 - [25] Padberg, J., Ehrig, H.: Petri net modules in the transformation-based component framework. J. Log. Algebr. Program. 67(1–2), 198–225 (2005) · [Zbl 1088.68129](#) · [doi:10.1016/j.jlap.2005.09.007](#)
 - [26] Padberg, J., Ehrig, H., Ribeiro, L.: Algebraic high-level net transformation systems. Math. Structures Comput. Sci. 5, 217–256 (1995) · [Zbl 0839.68068](#) · [doi:10.1017/S0960129500000724](#)
 - [27] Padberg, J., Gajewsky, M., Ermel, C.: Rule-based refinement of high-level nets preserving safety properties. Sci. Comput. Programming 40, 97–118 (2001) · [Zbl 0969.68109](#) · [doi:10.1016/S0167-6423\(00\)00022-8](#)
 - [28] Simeoni, M.: A Categorical Approach to Modularization of Graph Transformation Systems using Refinements. Ph.D. thesis, Università Roma La Sapienza (1999)
 - [29] Simeoni, M.: An Abstract Module Concept for Graph Transformation Systems. Electronic Notes of TCS 51 (2002) · [Zbl 1263.68093](#)
 - [30] Szyperski, C.: *Component Software – Beyond Object-Oriented Programming*. Addison-Wesley (1997)

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