Modal Pathway Diagrams for the Representation of Mathematical Models

Thomas Koprucki[1,*], **Karsten Tabelow**[1]

[1] *Weierstrass Institute for Applied Analysis and Stochastics, Berlin, Germany*

[*] Email: koprucki@wias-berlin.de

We present a concept for a machine-actionable representation of mathematical models. The approach is based on Model Pathway Diagrams (MPD), which specify the physical quantities that are described in the model as well as the relations between them (laws, constitutive equations), see [1,2]. MPDs provide a visual tool for understanding the structural properties of models as well as algorithms for numerical simulations. We illustrate our approach by application to the van Roosbroeck system describing the carrier transport in semiconductors by drift and diffusion. We discuss the block-based composition of models from simpler components. We indicate how MPDs can be used to assist a formalized representation of mathematical models based on OMDoc/MMT, a special machine-readable description language for mathematical documents, in order to obtain a machine-actionable as well as human-understandable representation of the mathematical knowledge and the domain-specific semantics they contain.

References

[1] M. Kohlhase, Th. Koprucki, D. Müller, K. Tabelow, Mathematical models as research data via flexiformal theory graphs, *In: Geuvers etal. (eds) Intelligent Computer Mathematics. CICM 2017*, Lecture Notes in Artificial Intelligence, vol. 10383, Springer (2017), pp. 224–238.

[2] Th. Koprucki, M. Kohlhase, K. Tabelow, D. Müller, F. Rabe, Model pathway diagrams for the representation of mathematical models, *Opt. Quant. Electron.*, **50** (2018), Art-Id 70, (10 pages)