THE KONTSEVICH GRAPH ORIENTATION MORPHISM REVISITED

ARTHEMY V. KISELEV*

Joint work with R. Buring (Johannes Gutenberg–Universität Mainz, Germany)

Abstract. The orientation morphism $\mathsf{O\vec{r}}\colon \Gamma \mapsto \dot{\mathcal{P}}$ associates differential-polynomial flows $\dot{\mathcal{P}} = \mathcal{Q}(\mathcal{P})$ on spaces of bi-vectors $\mathcal{P}$ on finite-dimensional affine manifolds N^n with (sums of) finite unoriented graphs Γ with ordered sets of edges and without multiple edges and one-cycles. It is known that d-cocycles $\boldsymbol{\gamma}$ with respect to the vertex-expanding differential d are mapped by $\mathsf{O\vec{r}}$ to Poisson cocycles $\mathcal{Q}(\mathcal{P}) \in \ker [\![\mathcal{P}, \cdot]\!]$, that is, to infinitesimal symmetries of Poisson bi-vectors $\mathcal{P}$. The formula of orientation morphism $\mathsf{O\vec{r}}$ was expressed by Kontsevich (1996), see also C. Jost (2013), in terms of the edge orderings as well as parity-odd and parity-even derivations on the odd cotangent bundle $\Pi T^* N^n$. By inspecting the rules of signs which are suggested by that algebraic formula of $\mathsf{O\vec{r}}$, we summarise its defining properties in terms of oriented graphs with edge orderings at all internal vertices. The reasoning is illustrated by the tetrahedral and by pentagon and heptagon-wheel cocycle flows.

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**Address*: Johann Bernoulli Institute for Mathematics and Computer Science, University of Groningen, P.O. Box 407, 9700 AK Groningen, The Netherlands. *E-mail*: `A.V.Kiselev@rug.nl`.