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Deformation theories and pre-Lie algebras with divided powers in positive characteristic

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An important result in deformation theory over a field of characteristic 0 asserts that every deformation problem can be controlled by a differential graded Lie algebra. More precisely, every solution of a deformation problem over a field of characteristic 0 can be seen as a Maurer-Cartan element in some dg lie algebra L. The isomorphisms classes of deformation problems are also in correspondence with the classes of Maurer-Cartan elements under the action of the integration of L into a Lie group called the gauge group. In 2015, Dotsenko-Shadrin-Vallette developed the deformation theory controlled by pre-Lie algebras, which are examples of Lie algebras, over a field of characteristic 0. They showed that the gauge group and its action on the Maurer-Cartan elements can be expressed in terms of pre-Lie operations. In this talk, we generalize such results in the positive characteristic context by developing a deformation theory controlled by pre-Lie algebras with divided powers. We also prove that this deformation theory satisfies a Goldman-Millson theorem which is valid over the integers. We apply this deformation theory to the computation of operad morphisms up to homotopy from the cobar construction of an augmented cooperad to an augmented operad.

Orateur: VERSTRAETE, Marvin