

*A (Virtual) Workshop on
Differential Graded Algebra Techniques in Commutative Algebra,
January 2-4, 2022, School of Mathematics, IPM, Tehran*

Abstracts of the Workshop Talks

(In Alphabetical Order)

*A (Virtual) Workshop on
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Lars Winther Christensen
Texas Tech University, USA

Talk 1

Differential Graded Algebra Structures on Free Resolutions

Free resolutions are fundamental in homological studies of modules, and whenever a free resolution can be endowed with additional structures of, say, algebraic or combinatorial nature, new tools can be brought to bear on their study. In this talk I will survey the possibilities and limitations to endowing free resolutions in local algebra with differential graded algebra structures. Free Resolutions.

Talk 2

Free Resolutions of Length 3

Every free resolution of length 3 over a local ring has a differential graded algebra structure. This structure on the resolution induces a graded-commutative algebra structure in homology, which can be used to classify cyclic modules of projective dimension 3 and, via Cohen's structure theorem, local rings of codepth 3. This classification project was started in the late 1980s. I will explain it and discuss the current status of affairs.

Talk 3

Generic Artinian Quotients of the Trivariate Polynomial Algebra

There is empirical evidence that artinian quotients of the polynomial ring in 3 variables over a field fall on a spectrum between Gorenstein and Golod. I will show how differential graded algebra structures on free resolutions play a key role in explaining this observed behavior.

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Examples of DG Algebra Resolutions

Keri Sather-Wagstaff
Clemson University, USA

We will present several examples of DG algebra resolutions from the literature, including the Koszul complex, Taylor resolution, and others that arise from these.

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Introduction to Homological Theory of dg Modules

Yuji Yoshino
Okayama University, Japan

In this series of lectures, I will explain the homological methods of dg modules focusing on the categorical aspects.

1. In the first lecture, starting with several definitions such as dg algebras, dg modules, cones, etc., I will give the precise definition of the homotopy category of dg modules and discuss its properties.
2. The main topic of the second lecture is a construction of semi-free resolutions for dg modules. Using this, we are able to obtain an equivalence between the derived category and the homotopy category consisting of semi-free dg modules.
3. In the last lecture, I will show how the derived equivalence is induced from a dg algebra quasi-isomorphism.