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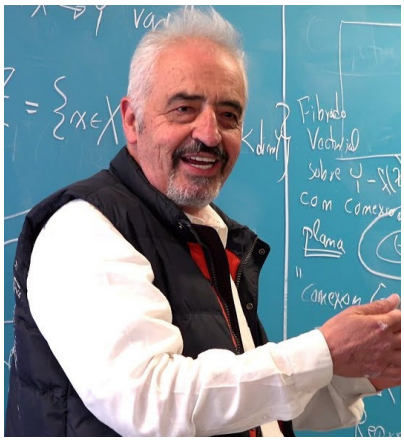

Xavier Gómez-Mont

CIMAT, México

Lefschetz structure on Vanishing Cohomology

Abstract: The Hard Lefschetz Theorem and the Riemann-Hodge bilinear relations are deep theorems that structure the cohomology groups of projective varieties. Relative versions of these theorems can be formulated for smooth families of projective varieties, say over a disc, giving structure to the cohomology bundles, that have the flat Gauss-Manin connection. When we have a family of varieties over the disc $f : X \to D$, which is smooth over the punctured disc, besides the above structure on the cohomology bundle of the punctured disc, we have the monodromy map. The Monodromy Theorem asserts that the eigenvalues of the monodromy map are roots of unity, so after a suitable base change of the disc branched at 0 we obtain a family of varieties whose monodromy map is unipotent, and its logarithm N is a well defined nilpotent map acting in cohomology. This map N carries the information of the non-semisimple part of the monodromy action. There is an interesting interplay between the filtration induced by N, the Lefschetz and Hodge decomposition of cohomology and the bilinear form induced by cup product giving the Hodge-Riemann bilinear relations. On the algebraic side, when the singularity is isolated, we have the Jacobian Algebra, Grothendieck non degenerate bilinear pairing in the Jacobian Algebra and multiplication by f in the Jacobian Algebra. This setting allows also to do Lefschetz type decomposition, as above. The relation between the topological picture and the algebraic picture is via a Theorem of Varchenko, that asserts that N is multiplication by f when we take the graded module with respect to the Mixed Hodge structure in the Jacobian Algebra. The objective of the presentation will be to describe the topological picture, the algebraic picture, and compare both. This is joint work with M. A. de la Rosa, from Cátedras CONACYT-UJAT.

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