Veerendra Vikram Awasthi

Research Summary:

During the academic year 2006-2007, I have been working mainly on these topics with Professor Satya Deo, my Ph. D. Supervisor:

1. Inverse system of nonempty objects with empty limit.

   We have constructed a concrete example of an inverse system of nonempty objects with empty limit. It has been often quoted, without giving an example, that there are inverse limit systems in which all the objects are nonempty and the connecting maps are onto, but the inverse limit is empty. By our example, it will easily follow that we can have such an inverse system in the category of modules and homomorphisms, category of topological spaces and continuous maps, etc.

2. Cohomological Dimension Theory with respect to different cohomologies.

   we have been trying to compute all the singular homology groups of the n-dimensional Hawaiian earring. Barrat and Milnor had showed only that these groups are nonzero in infinitely many dimensions, but the actual computation had been an open problem for quite some time. We have succeeded in determining them precisely in several dimensions.

   In the theory of cohomological (or homological) dimensions, it is invariably the Čech cohomology or the sheaf theoretic cohomology which is used. The simple reason for such a preference is the fact that if X is a paracompact Hausdorff space of covering dimension n, then the Čech homology groups satisfy the property that $H_q(X; G) = 0$, $\forall q > n$ and for all coefficients G. The question as to what happens if one uses some other cohomology or homology theory, was first answered very decisively by Barratt and Milnor. They constructed a compact, connected, metric space X of covering dimension r (for any given $r \geq 2$) which had the surprising property that its singular homology groups $H_q(X; Q)$ with rational coefficients were non-zero for infinitely many values of q greater than r. More precisely, they proved that $H_q(X; Q) \neq 0$ whenever $q \equiv 1 \mathrm{mod}(r-1)$. Consequently, the integral singular homology groups $H_q(X) \neq 0$ for $q \equiv 1 \mathrm{mod}(r-1)$. We have proved their result that $H_q(X) = 0$ for $r < q < 2r - 1$. We have also constructed a compact, connected, metric space Y of covering dimension $2r - 2$ $(r > 2)$ which has the property that Y is $(r-1)$-connected and $H_q(X; Q) \neq 0$, $\forall q \geq 2r - 2$.

Preprints:

1. Veerendra Vikram Awasthi and Satya Deo, *An Inverse system of nonempty objects with empty limit,* (communicated).

2. Veerendra Vikram Awasthi and Satya Deo, *Homology and Dimension - Further pathological examples,* (under submission).

Conference/Workshops Attended:

1. *Symposium on "Analysis and Approximation"*, Department of Mathematics, R. D. University, Jabalpur, INDIA, April, 2006.

2. *International Workshop and conference on "Geometric Methods in Topology"*, Indian Institute of Sciences (IISc.) Banglore, INDIA, June, 2006.

3. 72^{nd} *Annual Conference of the Indian Mathematical Society,* Department of Mathematics, R. D. University, Jabalpur, INDIA, December, 2006.

Invited Lectures/Seminars:

- *Strongly Contractible Polyhedra which are not Simply Contractible at n Points for any* $n \geq 2$, 72^{nd} Annual Conference of the Indian Mathematical Society, R. D. University, Jabalpur, INDIA, December, 2006.