



International  
Scientific Conference

# Algebraic and Geometric Methods of Analysis

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## LIST OF TOPICS

- Algebraic methods in geometry
- Differential geometry in the large
- Geometry and topology of differentiable manifolds
- General and algebraic topology
- Dynamical systems and their applications
- Geometric problems in mathematical analysis
- Geometric and topological methods in natural sciences

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ІНТЕРНАЦІОНАЛЬНИЙ ЦЕНТР СПІВРОБОТИ

## A short note on Hurewicz and $\mathcal{I}$ -Hurewicz properties in topological spaces

Upasana Samanta

(Jadavpur University, Kolkata-700032, West Bengal, India)

*E-mail:* samanta.upasana@gmail.com

**Theorem 1.** *Let  $X$  be an  $\epsilon$ -space and let  $\mathcal{I}$  be an ideal having a pseudounoin, then  $X$  satisfies  $S_{fin}(\Omega, \mathcal{O}^{\mathcal{I}\text{-gp}})$  if and only if  $X$  has Hurewicz property [4].*

**Lemma 2.** [1, Theorem 4.1.2] (see also [5]) *An ideal  $\mathcal{I}$  of  $\mathbb{N}$  is meager if and only if there is a partition  $\{P_n : n \in \mathbb{N}\}$  of  $\mathbb{N}$  into finite sets such that each  $A \in \mathcal{I}$  contains atmost finitely many  $P_n$ 's.*

**Proposition 3.** *For a space  $X$  and a meager ideal  $\mathcal{I}$ ,  $X$  satisfies  $S_{fin}(\Lambda, \mathcal{O}^{\mathcal{I}\text{-gp}})$  if and only if  $X$  has Hurewicz property.*

**Problem 4.** Is there a Lindelöf non- $\epsilon$ -space such that  $S_{fin}(\Omega, \mathcal{O}^{\mathcal{I}\text{-gp}})$  holds but  $S_{fin}(\Lambda, \mathcal{O}^{\mathcal{I}\text{-gp}})$  fails?.

**Definition 5.** A space  $X$  is said to have  $\mathcal{I}$ -Hurewicz property (in short  $\mathcal{I}\mathcal{H}$ ) if for each sequence  $(\mathcal{U}_n : n \in \mathbb{N})$  of open covers of  $X$  there is a sequence  $(\mathcal{V}_n : n \in \mathbb{N})$  such that for each  $n \in \mathbb{N}$ ,  $\mathcal{V}_n$  is a finite subset of  $\mathcal{U}_n$  and for each  $x \in X$ ,  $\{n \in \mathbb{N} : x \notin \cup \mathcal{V}_n\} \in \mathcal{I}[2]$ .

**Theorem 6.** *Let  $X$  be an  $\epsilon$ -space satisfying  $CDR_{sub}(\Lambda, \Lambda)$  and let  $\mathcal{I}$  be a meager ideal of  $\mathbb{N}$ . If  $X$  has  $\mathcal{I}$ -Hurewicz property then  $X$  also has Hurewicz property.*

**Theorem 7.** *If a filter  $\mathcal{F}$  does not have  $\mathcal{I}$ -Hurewicz property then  $\chi(\mathcal{F}) \geq \mathfrak{b}(\mathcal{I})$ .*

**Remark 8.**  $CH$  denotes the Continuum Hypothesis. Assume  $\neg CH$ . Let  $\mathcal{I}$  be an ideal of  $\mathbb{N}$  and let  $k$  be an infinite cardinal satisfying  $\mathfrak{b} < k < \mathfrak{b}(\mathcal{I})$ . There is  $X \subset \mathbb{N}^{\mathbb{N}}$  of size  $\mathfrak{b}$  which is not a Hurewicz space. But  $X$  is  $\mathcal{I}$ -Hurewicz.

**Example 9.** There exists a non- $\mathcal{I}$ -Hurewicz filter of character  $\mathfrak{b}(\mathcal{I})$ . Consider a set  $\{f_\alpha : \alpha < \mathfrak{b}(\mathcal{I})\}$  which is not  $\mathcal{I}$ -bounded. Let  $\mathcal{F}$  be a filter on  $\mathbb{N} \times \mathbb{N}$  generated by the family  $\{F_\alpha : \alpha < \mathfrak{b}(\mathcal{I})\}$  where  $F_\alpha = \{(n, m) : m \geq f_\alpha(n), n \in \mathbb{N}\}$ . For each  $n \in \mathbb{N}$ ,  $\mathcal{U} = \{U(n, m) : m \in \mathbb{N}\}$  is an open cover of  $\mathcal{F}$  where for each  $n, m \in \mathbb{N}$ ,  $U(n, m) = \{A \subset \mathbb{N} \times \mathbb{N} = \min\{k \in \mathbb{N} : (n, k) \in A\}\}$ .

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