

# Bridging Uncertainty and Connectivity: IFSH Tree Models for Dynamic Fiber Cable Networks

Myithili.K.K

Dean Academics, Associate Professor, Department of Mathematics,  
Vellalar College for Women, Erode-638 012, Tamil Nadu, India

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Karishma.B

Research Scholar, Department of Mathematics,  
Vellalar College for Women, Erode-638 012, Tamil Nadu, India

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## Abstract

Intuitionistic Fuzzy(IF) Semihypergraphs provides an effective mathematical frame work for modeling uncertainty in complex system involving multi-level relationships. This paper introduces the concept of IFSemihyperwalk, IFSemihyperpath, IFSemihypertrail, IFSemihypertree, Host tree integrating with IFSemihypergraph. New definitions and structural parameters are proposed. Fundamental theorem and lemma of the proposed model are investigated and established. Futhermore, real-time applications in network analysis and decision-making are discussed, highlighting the effectiveness of Intuitionstic Fuzzy Semihypergraph (IFSHG) in handling the imprecise and uncertain information on flexibility and stability of the Fiber optic connection. Finally it is proved that the host tree structure remains invariant under the replacement of IFSemihyperedges along unique path, while preserving the Intuitionistic fuzzy characteristics.

**Keywords** : IFSemihyperwalk, IFSemihyperpath, IFSemihypertree, Host tree, Connected and disconnected, Fiber optic connection.

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\*mathsmyth@gmail.com

†b.karishma@vcw.ac.in

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