

Steiner Strong Sum Distance in Fuzzy Graphs

Kripa Shaji * and M. S. Sunitha †

Department of Mathematics, National Institute of Technology Calicut, Kerala, India - 673601

Abstract

Distance in fuzzy graphs is a fundamental concept crucial for analyzing information flow, network resilience and optimization of pathways. This work presents a generalized framework for distance that capture the structural relationship of a set of vertices rather than just pairs of vertices. A novel concept of Steiner strong sum distance (SSSD) is proposed as a generalization of strong sum distance, facilitating the analysis of collective interactions among multiple vertices. An algorithm for determining SSSD in $\mathcal{O}(3^k n^4)$ running time is presented. Basic properties of SSSD are investigated and evaluated SSSD for several classes of fuzzy graphs including complete fuzzy graph, complete bipartite fuzzy graph, saturated fuzzy cycle, fuzzy wheel graph and fuzzy trees. Furthermore, the notion of eccentricity with respect to SSSD is studied, along with its key properties. Necessary conditions for a fuzzy graph to be Steiner strong sum selfcentered are derived and proved the generalized version of Hedetniemi's construction based on SSSD. Additionally, the Steiner strong sum diameter of complete fuzzy graph and fuzzy tree is obtained and the conditions for them to be Steiner strong sum selfcentered are examined.

Keywords: Steiner strong sum distance, Steiner strong sum eccentricity, Steiner strong sum selfcentered, Steiner strong sum diameter, fuzzy graph.

References

- [1] K. R. Bhutani, A. Rosenfeld, Strong arcs in fuzzy graphs, *Inf. Sci.* 152 (2003) 319 - 322.
- [2] G. Chartrand, O. R. Oellermann, S. Tian, H. B. Zou, Steiner distance in graphs, *Čas. Pěs. Mat.* 114 (1989) 399 - 410.
- [3] O. R. Oellermann, S. Tian, Steiner Centers in Graphs, *J. Graph Theory* 14 (1990) 585 - 597.
- [4] M. Tom, M. S. Sunitha, Strong Sum distance in Fuzzy Graphs, *SpringerPlus* 4 (2015) 1 - 14.

*kripashaji28@gmail.com

†sunitha@nitc.ac.in