

# Chapter 94

## Magnetic Field Model (MFM) in Soft Computing and Parallelization Techniques for Self Organizing Networks (SON) in Telecommunications

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### ABSTRACT

*Self Organizing Networks (SON) requires efficient algorithms and effective real time and faster execution techniques to meet the SON requirements (use cases & desired functionalities) (as cited in Srinivasan R and Premnath K N., 2011). The essence of this journal paper is to showcase that Magnetic Field Model (MFM) (as cited in Premnath K N et al., 2013) can be applied in prominent soft computing and parallelization techniques for SON applications, functionalities and use cases. Vast literature and practical approaches are available as part of advancements in Machine Learning, Artificial Intelligence and Fuzzy logic. Based on inspiration from nature's behavior Swarm Intelligence derived from the behaviors of Ant colony and Genetic Algorithms (Evolutionary Algorithms) are some algorithmic techniques to mention. Parallelization of MFM for centralized, hybrid SON use cases is discussed with key inspiration from Google Map Reduce (as cited in Jeffrey Dean and Sanjay Ghemawat., 2004).*

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## INTRODUCTION

Magnetic Field model is inspired from the basic behaviors of Magnets (like poles repel and unlike poles attract). Based on these fundamental properties attraction and repulsion factors are derived for the network elements and applied as part of SON functionalities (as cited in Srinivasan R and Premnath K N., 2011).

Requirements about SON are available from Next Generation Mobile Networks (NGMN) alliance requirement documents, as mentioned below:

- NGMN Recommendation on SON and O&M Requirements (as cited in Frank Lehser et al., 2008)
- NGMN Use Cases related to Self Organizing Network, Overall Description (as cited in NGMN Technical Working Group “Self Organizing Networks”, Project 12 et al., 2008)
- NGMN Top OPE (Operational Efficiency) Recommendations (as cited in Frank Lehser and P-OPE Project., 2010)

When such a model is applied on the Network Elements (NEs), it is possible for the NEs to indigenously take decision. In the advancement of Heterogeneous Networks (HetNets) and initial indication of 5G-network motivation, it is becoming more evident that NEs have to indigenously decide about basic parameter configurations that are effective for them at the given conditions. Given conditions range from coverage (service area), capacity utilization (network usage) and environmental conditions (terrain, building heights, radio wave reflection, absorption conditions and weather).

Usage of MFM with soft computing methods is discussed in detail considering both decentralized and centralized SON implementations. For decentralized SON basic applicability of MFM with soft computing methods is sufficient. In Centralized SON implementation due to the volume of NEs are high and to expect better time execution parallelization methods are ideal to be applied for MFM along with soft computing methods.

Objective of this paper is to propose MFM in common soft computing methods and parallelization techniques for SON use cases and desired functionalities. Alternative methods are proposed for each SON use cases in using MFM.

## PROPERTIES OF MFM

Magnets repel for like poles and attract for unlike poles (see Figure 1). This basic property indicates dual act and all the binary arithmetic system is applicable. Another key factor that is unique with MFM (as cited in Premnath K N et al., 2013) is the repulsion factor and attraction factor based on the magnetic field strength. This attribute provides lots of base for the Soft computing methods. Especially reflecting the fuzziness, this is much needed for soft computing.

*Figure 1. Behavior of magnets (attraction and repulsion factors)*



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