

**Spatial Mappings for Planning and Optimization of Cellular Networks**

**Abstract:**

In cellular networks, users are grouped into different cells and served by different access points (base stations) that provide wireless access to services and applications. In general, the service demand is very heterogeneous, non-uniformly distributed, and dynamic. Consequently, radio access networks create very *irregular* topologies with more access points, where service demand is concentrated. While this dynamism requires networks with the ability to adapt to time-varying conditions, the non-uniformity of the service demand makes the planning, analysis, and optimization difficult. In order to help with these tasks, a framework based on canonical domains and spatial mappings (e.g., conformal mapping) have recently been proposed. The idea is to carry out part of the planning in a canonical (perfectly symmetric) domain that is connected to the physical one (real-scenario) by means of a spatial transformation designed to map the access points *consistently* with the service demand. This paper continues the research in that direction by introducing additional tools and possibilities to that framework, namely the use of centroidal Voronoi algorithms and non-conformal composite mappings. Moreover, power optimization is also introduced to the framework. The results show the usability and effectiveness of the proposed method and its promising research perspectives.

**Existing System:**

In particular, the problem of finding the number of access points is also referred to as dimensioning, and this initial step aims at providing the required capacity for the service demand volume that is expected. However, in practice, both dimensioning and sites positioning are very difficult problems because the service demand is not uniformly distributed and it is quite diverse and dynamic. Nowadays, taking into account the continuous evolution of radio access technologies, and the new concepts and paradigms that are expected for the fifth generation (5G) of cellular networks, the boundary between planning and

optimization tasks becomes blurred. Indeed, according to the excellent work presented in, planning and optimization are iterative tasks that go *hand-in-hand*.

**Proposed System:**

Let us shortly discuss about the nature of the contribution to make clear the main goal of this research and its scope. We emphasize that our goal has not been to create a technical methodology or algorithm that aims at competing with existing network planning methods. There are many effective heuristic network planning methods applying e.g. genetic algorithms, and commercial tools that are routinely used to create practically viable network deployments. Instead, our main goal has been to develop a *deterministic methodology* that provides a new general theoretical framework that can be used to analyze and shed more light on the dependencies between different factors (service demand, load, channels, etc).

We also note that in the applied approach, spatial mappings carry the information about the cellular topology. In system analysis this means that a rich mathematical machinery on mappings becomes a viable tool while studying the properties of the topology. Of course, it is also our goal that the algorithmic realization of the proposed methodology becomes in long run competitive with mainstream heuristic algorithms, but at this stage of research and development, synthetic scenarios, capturing the irregular features of real-world deployments, suffice as proof of concept.