**A NOVEL TOPOLOGY FOR LATTICE TELECOMMUNICATION TOWERS DEVELOPED THROUGH A COMPUTATIONAL MORPHOGENESIS PROCESS**

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**Executive summary**

The sudden increase in the usage of services provided by the telecommunication industry led to the creation of new competent aerials which are mounted on tall lattice telecommunication towers and masts. The need to serve the demands placed upon the telecommunication industry required the establishment of new aerials and consequently the erection of new and taller lattice structures. As a result, many researchers investigated their **(i)** failure modes, **(ii)** optimum type of bracing and structural members based on financial factors and structural performance for varying height lattice towers, and **(iii)** performance and aesthetic value when using CHS. In turn, this project aimed to use advanced computational structural topology optimization (STO) techniques to produce a novel lattice self-supporting tower that will incorporate improved aesthetic value and structural performance but at the same time maintain characteristics that will enable its function.

To accomplish the aforementioned aim it was deemed necessary to study the field of these special structures and understand how the overall shape, the footprint and bracing type affect their functionality and performance. Afterwards, the effect of wind and ice on the towers was also discussed. The wind actions which govern the design of such slender structures were applied in the optimization analyses as lateral static loads. It was found, furthermore, that STO has not been previously applied for the creation of lattice towers. Therefore, to interpret the results of this project solely current applications on buildings were used.

Ultimately, using conceptual topology optimization layouts with a sequential rationale, a new exoskeleton representing a lattice self-supported tower composed of ‘high-waisted’ bracing type was developed. Modal analysis demonstrated satisfactory performance for the new tower compared to a conventional tower found in Greece and design for wind actions as well as seismic loads. It is remarkable that the optimized tower possesses improved aesthetic value and maintains functional utility characteristics (i.e., the cap for antenna fitting).