

Topology optimization of structures is the most difficult class among problems of structural design because of its combinatorial character which leads to an exponential complexity. In the last decades, the challenge of the increasing complexity of the systems studied and the capacity of the optimization methods to solve these problems in a reasonable time kept increasing. In fact, in spite of recorded progress, the search continues for more powerful and more robust programs that are capable of handling nonlinear problems (geometry, material) and allow integration of multiple disciplines, including topology, in the design. An alternative methodology, based on the Cellular Automata (CA) paradigm, can be implemented on both traditional and parallel hardware architectures. The CA method is also known to take advantage of the acceleration effect of multigrid (MG) schemes.

However, several applications need to take into account the effect of design dependent loads on the topology optimization problem. In this thesis, the wind loading will be introduced in the topology optimization formulation, especially for the case of the design of wind turbine.