Many design problems in engineering and technology are very challenging, due to their complexity and stringent constraints. Algorithms tend to be problem-specific, and computationally expensive. In addition, mathematical models underpinning a numerical simulator for design optimization are often highly nonlinear, and even of black-box type via an FEM package.

To obtain an optimal design solution, we have to use both smarter algorithms and more accurate models. Accurate, high-fidelity models often increase computing time significantly, and therefore, in many cases, the most sensible choice is to use better, smarter optimization algorithms.

Recently, nature-inspired metaheuristic algorithms have become increasingly powerful and popular. They have also become an important part of contemporary computational intelligence.

In this presentation, we will review some of the recent metaheuristic algorithms and their applications. We will also analyse the key components of metaheuristics and try to seek to improve their efficiency by mimicking and learning from Nature. We also give a few examples in real-world applications and outline some open problems for further research.