# Optimization of Turbine disk based on sequential sampling approach and Kriging models[1]

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Nowadays surrogate models (also known as metamodels) are widely used in the engineering design and optimization to fit the real models, thus significantly reduce the number of the computationally expensive numerical simulations. It is noted that the accuracy of metamodels largely depends on the quality of design of computer experiments (DOE).

In this paper, we employ a space-filling sequential sampling approach based on space reduction and the Kriging technique to effectively fit the objective function and constraint functions of the problem of turbine disk shape optimization. The proposed sequential sampling approach can efficiently generate sample points with good space-filling and projective properties in two steps: firstly, it identifies the represented intervals of existing samples to reduce the original design space. Any point falls in the reduced design space automatically maintains a good projective property; secondly, select the new samples with the best space filling property from the random points generated in the reduced design space.

The object is to minimize the disk mass. Ten geometric parameters such as the rim radius, bore radius, rim width, etc. are selected as the design parameters. Constraints for the turbine disk optimization consist of size constraints and strength performance constraints. The size constraints provide the parameter ranges and the several strength performance constraints are set according to design rules. In the optimal design process, firstly we pay attention on iteratively adding samples to construct the Kriging models to reach the desired accuracy, then the genetic algorithm (GA) is employed to find the optimum in the well-fitted models. All the above process is automatically run in MATLAB code. Numerical results of turbine disk show that the optimization technique combined with the sequential sampling approach and Kriging models can obtain the fairly accurate solution within a reasonable time.

**Keywords:** Sequential, Space reduction, Kriging, Disk, Optimization

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