14th World Congress on Computational Mechanics (WCCM XIV)
8th European Congress on Computational Methods in Applied Science and Engineering (ECCOMAS 2020)
July 19–24, 2019, Paris, France

ACCELERATING THE DESIGN OPTIMIZATION PROCESS TRACK NUMBER 1300

SIMONA PEROTTO[*], GILHO YOON[†], ODED AMIR[▽], NICOLA FERRO[*], AND YOUNGSOO CHOI[◇]

[*] MOX – Politecnico di Milano, Piazza L. da Vinci, 32, I-20133 Milano, Italy
{simona.perotto, nicola.ferro}@polimi.it / www1.mate.polimi.it/ simona

[†] Hanyang University, 222 Wangsimni-ro, Sageun-dong, Seongdong-gu, Seoul, South Korea
ghy@hanyang.ac.kr / http://multiphysics.hanyang.ac.kr/board/bbs/board.php?bo_table=Professor

[▽] Technion - Israel Institute of Technology, Haifa, 3200003, Israel
odedamir@technion.ac.il / https://structopt.net.technion.ac.il

[◇] Lawrence Livermore National Laboratory, 7000 East Ave, Livermore, CA 94550, USA
choi15@llnl.gov / https://people.llnl.gov/choi15

Key words: design optimization, model order reduction, surrogate modeling, space approximation

ABSTRACT

Design optimization is a powerful tool that enables an automatic design process with the help of sophisticated computational models. It is widely used in industries, academia, national laboratories for various applications, mainly including aerospace, structural, mechanical engineering, but expanding to fluids, acoustics, electromagnetics, and optics.

Both shape and topology optimization procedures are driven by the minimization/maximization of a certain quantity of interest (e.g., the static compliance of an elastic system, the dissipated energy in a fluid, the fundamental vibration frequency of a body) so that specific requirements are fulfilled. These latter usually involve design specifications (e.g., the volume fraction, a local control over the displacement or stress) and are mathematically expressed as equalities or inequalities, whereas a Partial Differential Equation (PDE) models the underlying physical system (i.e., PDE-constrained optimization).

Several numerical methods are currently available in the literature to efficiently deal with both shape and topology optimization in disparate settings. However, this process is computationally expensive mainly because of the requirement of solving a large system of equations at every optimization iteration. Goal of this Minisymposium is to provide the state of the art on advanced techniques for accelerating the desing optimization process. We welcome contributions on the following potential topics within design optimization, but not limited to:

- Model order reduction
- Surrogate modeling
- Accelerating the solution process of linear system equations
- Parameter space approximation
- Adjoint space approximation