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STS-06

An Efficient Multidisciplinary Design Framework for Application in Industry

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Session Abstract

Keywords: *Optimization methods, adjoint solvers, multidisciplinary case studies, physical validation*

Optimization methods based on adjoint solvers have become an attractive tool in industrial research. From external aerodynamics to hydrodynamics, they are used to find new designs for the future that minimize energy losses and increase safety. For example, this has been very successful for airfoils, turbine blades or even boat hulls.

Besides their accuracy, adjoints can provide objective function gradients with respect to any design parameter at low computational cost. Over the last years, more and more multidisciplinary design problems, like fluid-structure interaction and conjugate heat transfer, had been approached via this technology.

However, many implementations suffer from being quite specific to a certain application or solver, which makes it hard to transfer them to industrial research departments. In a joint project funded by the Bayerische Forschungsstiftung (Bavarian Research Foundation), three established open-source projects, KRATOS, SU2 and CoDiPack, are combined into a framework that is highly adaptable and that can be applied to engineering problems that are not yet known. In order to highlight some of its capabilities, this STS contains talks that present multidisciplinary case studies, physical validations via measurements and applications of the software at Bosch and Bosch Rexroth.

List of paper titles and speakers:

Grid-based Shape Optimization to Reduce Pressure Loss under Stress Constraints in Structures with Internal Flow
Daniel Baumgärtner, TU München, Munich, Germany, daniel.baumgaertner@tum.de
Kai-Uwe Bletzinger, TU München, Munich, Germany, kub@tum.de

Adjoint-based Free-shape Optimization of Pin-fin Heat-exchangers
Tobias Kattmann, Bosch Corporate Research, Renningen, Germany, tobias.kattmann@de.bosch.com
Ole Burghardt, TU Kaiserslautern, Kaiserslautern, Germany, ole.burghardt@scicomp.uni-kl.de

Numerical and Experimental Validation of an Elbow Shape Optimized for Minimal Pressure Loss
Eman Bagheri, bag@ipat.uni-erlangen.de
Stefan Becker, sb@ipat.fau.de
Friedrich-Alexander University Erlangen-Nürnberg, Erlangen, Germany,
Daniel Baumgärtner, TU München, Munich, Germany, daniel.baumgaertner@tum.de

Multidomain Adjoint Optimization Method for Pressure Loss and Lifetime
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