11th World Congress on Computational Mechanics (WCCM XI)
5th European Conference on Computational Mechanics (ECCM V)
6th European Conference on Computational Fluid Dynamics (ECFD VI)
July 20 - 25, 2014, Barcelona, Spain

# Kernel-based Surrogate Modelling for Multiscale Problems

**D. Wirtz**[1], **N. Karajan**[2], **B. Haasdonk**[1]
[1] Institute of Applied Analysis and Numerical Simulation, University of Stuttgart, Pfaffenwaldring 57, 70569 Stuttgart, Germany, daniel.wirtz, haasdonk@mathematik.uni-stuttgart.de
[2] DYNAmore GmbH, Industriestr. 2, 70565 Stuttgart, Germany, nils.karajan@dynamore.de

**Key Words:** *Kernel Methods, Multiscale Problems, Greedy Algorithm, Support-Vector-Machines*

In the current presentation we give some recent results for the application of kernel methods for reducing computational complexity in multiscale model simulation. In particular, we consider the scenario of multiscale models, which are characterized by a computationally intentive microscale model, that is requested in a many-query fashion during the simulation of the macroscale model. In this view, the microscale model can be seen as a vectorial function, that needs to be replaced by a rapid and accurate surrogate.
As surrogate modelling technique, we use kernel methods, which are powerful machine learning techniques, that provide data based kernel expansions. Due to the typical sparsity of these methods, the resulting models serve the goal of rapid evaluation. We present a Vectorial Kernel Orthogonal Greedy Algorithm (VKOGA), that incrementally constructs highly accurate vectorial approximations. The algorithm can be substantiated with theoretical convergence rate statements [1]. We apply the VKOGA and Support Vector Regression (SVR) in two different applications: First a porous media flow problem including nonclassical shocks, then a biomechanical application of the human spine [2]. In both cases we obtain a considerable speedup by the surrogate kernel micromodels.

**Acknowledgement**
We acknowledge funding by the DFG (German Research Foundation) and the Baden-Württemberg Stiftung gGmbH.

## REFERENCES

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