

Second MODE Workshop on Differentiable Programming for Experiment Design



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Type: **Keynote talk**

Keynote Lecture: High-performance Algorithmic Differentiation

Tuesday, 13 September 2022 12:00 (50 minutes)

Applying algorithmic differentiation (AD) to computer code is a challenging task. To this end, several tools have been developed over the last decade, which ease the application of AD. With MeDiPack, it is no longer a problem to handle all kinds of MPI communication. The recently released library OpDiLib provides out of the box AD capabilities for OpenMP parallel codes. Modern AD tools, like CoDiPack, make use of expression templates to improve the taping speed and memory footprint of the differentiated code. This makes the application of AD to computer code much more applicable. The talk will show use cases where AD has been applied to large scale applications and on these uses cases the techniques for applying AD will be discussed. Therefore, we will look into the tools MeDiPack, OpDiLib as well as CoDiPack and why they have been implemented and how they solve the usual problems of applying AD. For AD tools, a general overview is given on the implementation strategies and their advantages and drawbacks. With this information a more elaborated comparison on AD tools can be performed and criteria for an efficient AD tool can be determined. From these criteria CoDiPack, has been developed. One question that is seldom addressed in applying AD to a code, is how the code can be validated. We will look at techniques how this can be done and develop from these insights a framework that can be used to not only validate the differentiated code but also to analyse its AD performance. This can then be used to further improve the differentiated code. Finally, a conclusion is drawn and we will elaborate what the next generation of AD tools needs to provide for more efficiency.

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Session Classification: Opening and Keynote Lectures