QAIMS

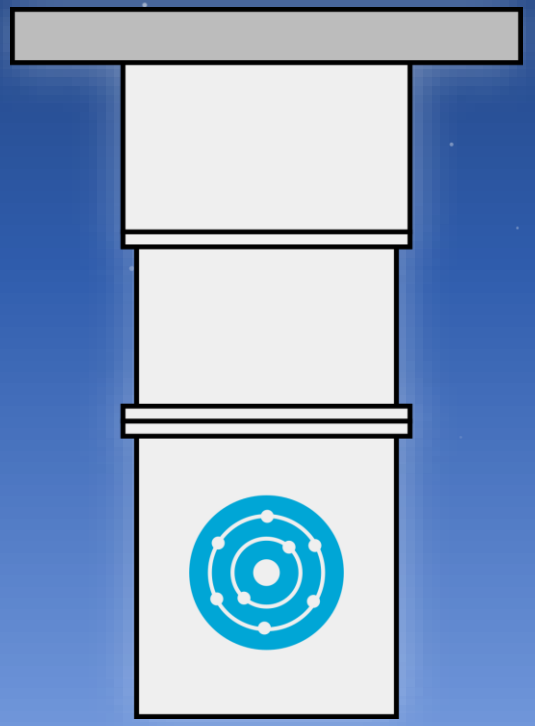
Quantum-Enhanced AI: Innovating Sustainable Materials and Structures in Aerospace

TU Delft

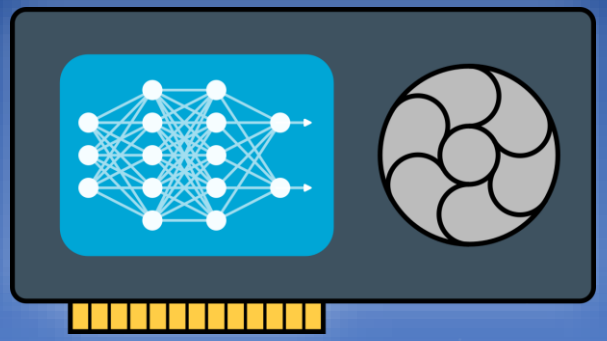
Dr. Sebastian Feld

October 3rd, 2024

Quantum Computing



Machine Learning



QAIMS

Quantum-Enhanced AI: Innovating Sustainable Materials and Structures in Aerospace

TU Delft

Dr. Sebastian Feld

October 3rd, 2024

Supervisors

Boyang Chen
Associate Professor
TU Delft

Matthias Möller
Associate Professor
TU Delft

Roeland De Breuker
Associate Professor
TU Delft

Yinglu Tang
Assistant Professor
TU Delft

Sebastian Feld
Assistant Professor
TU Delft

Qi-Jun Hong
Assistant Professor
Arizona State University

PhD Students

Swapan Madabhushi Venkata
TU Delft

Arne Wulff
TU Delft

Philip Würzner
TU Delft

Koen Mesman
TU Delft

TU Delft | AIMS

optimization of laminated composite materials

atomistic simulation at extreme temperatures

Swapan Madabhushi Venkata
TU Delft

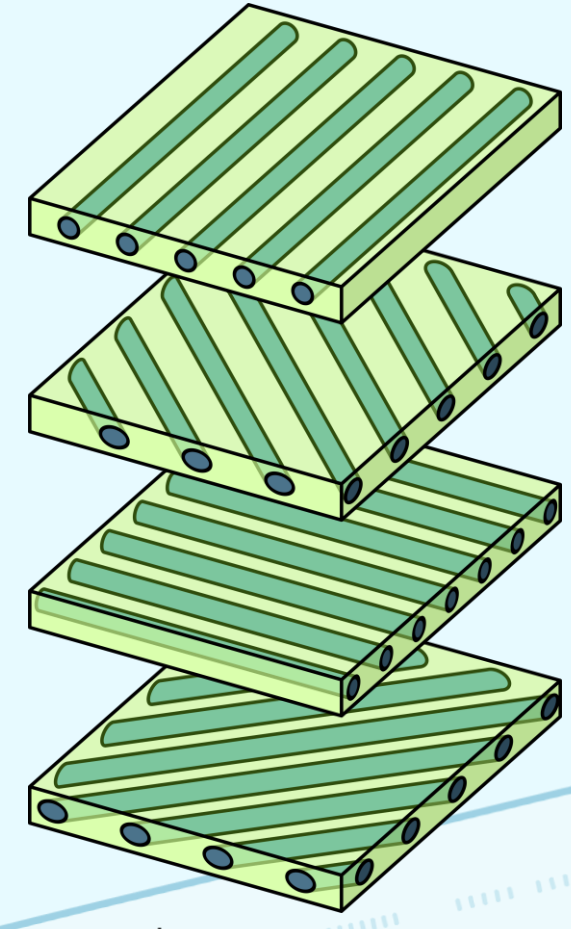
Arne Wulff
TU Delft

Philip Würzner
TU Delft

Koen Mesman
TU Delft

TU Delft | AIMS

optimization of laminated composite materials



Swapan Madabhushi Venkata
TU Delft

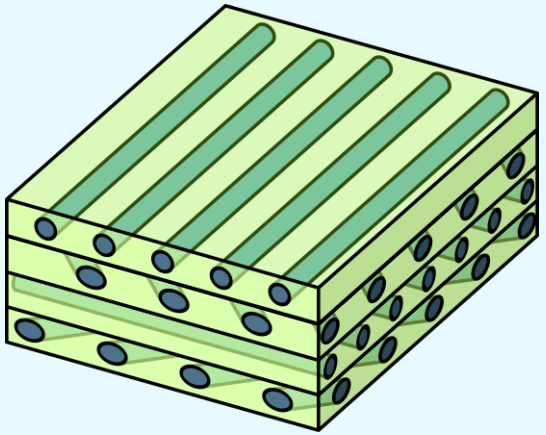
Arne Wulff
TU Delft

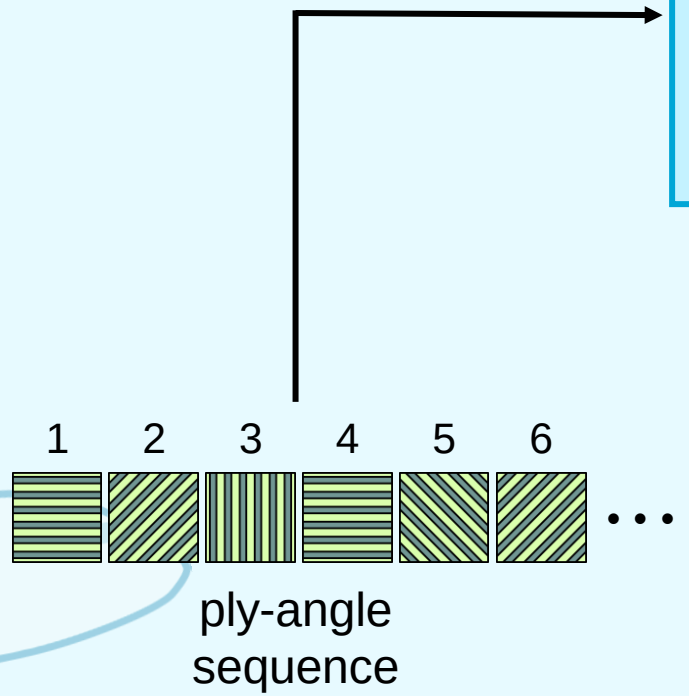
TU Delft | AIMS

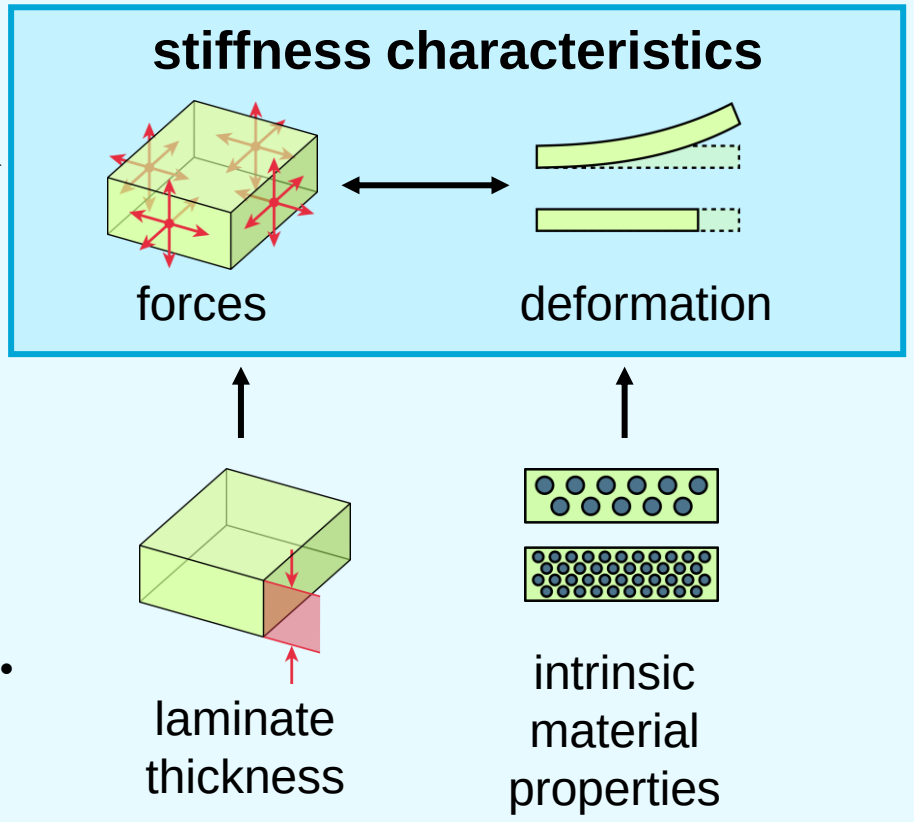
optimization of laminated composite materials

Swapan Madabhushi Venkata
TU Delft

Arne Wulff
TU Delft



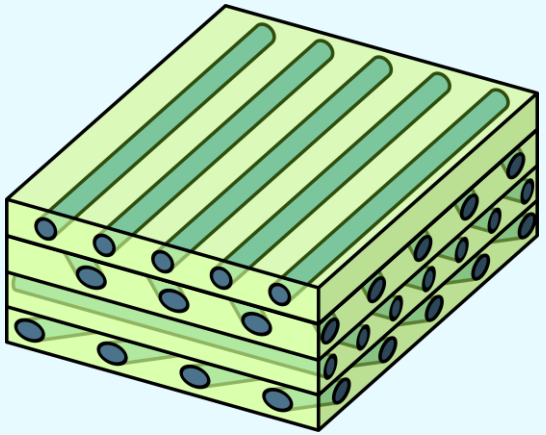


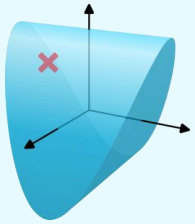


optimization of laminated composite materials

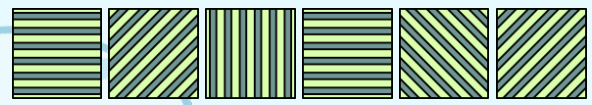
Swapan Madabhushi Venkata
TU Delft

Arne Wulff
TU Delft



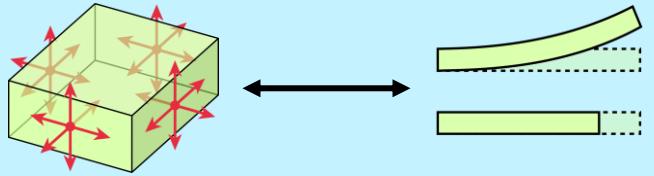


lamination parameters
(12)



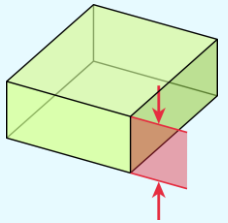
ply-angle sequence

stiffness characteristics

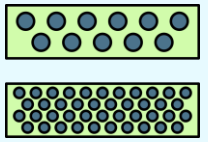


forces

deformation

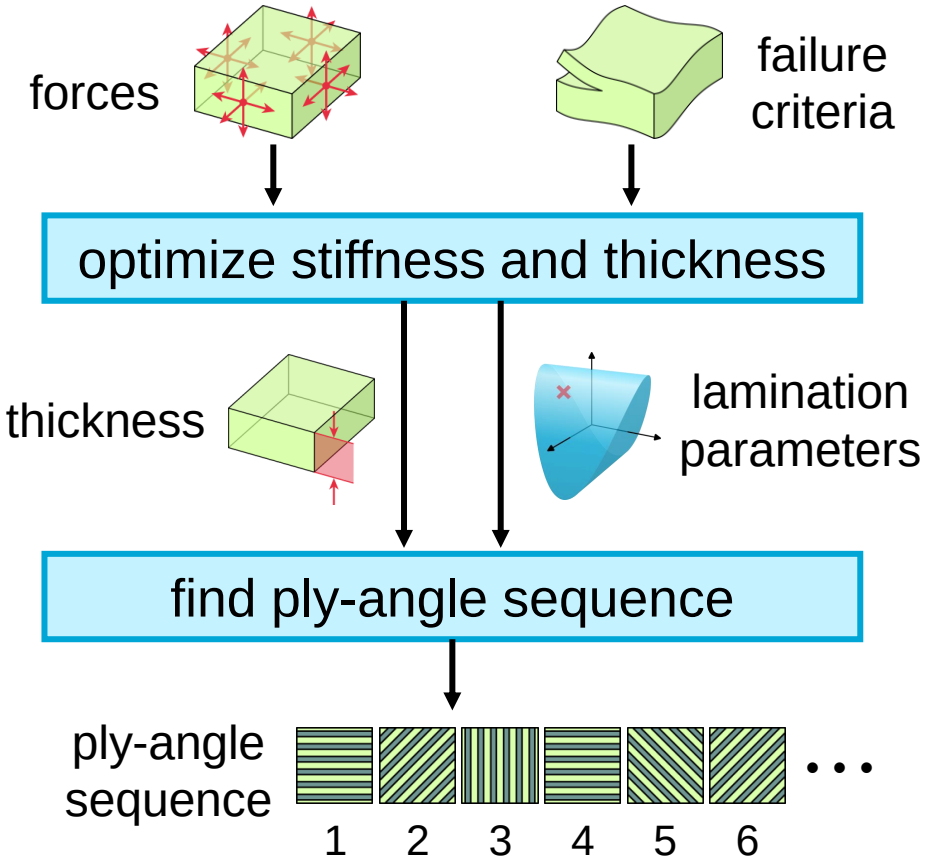


laminate thickness



intrinsic material properties

optimization of laminated composite materials

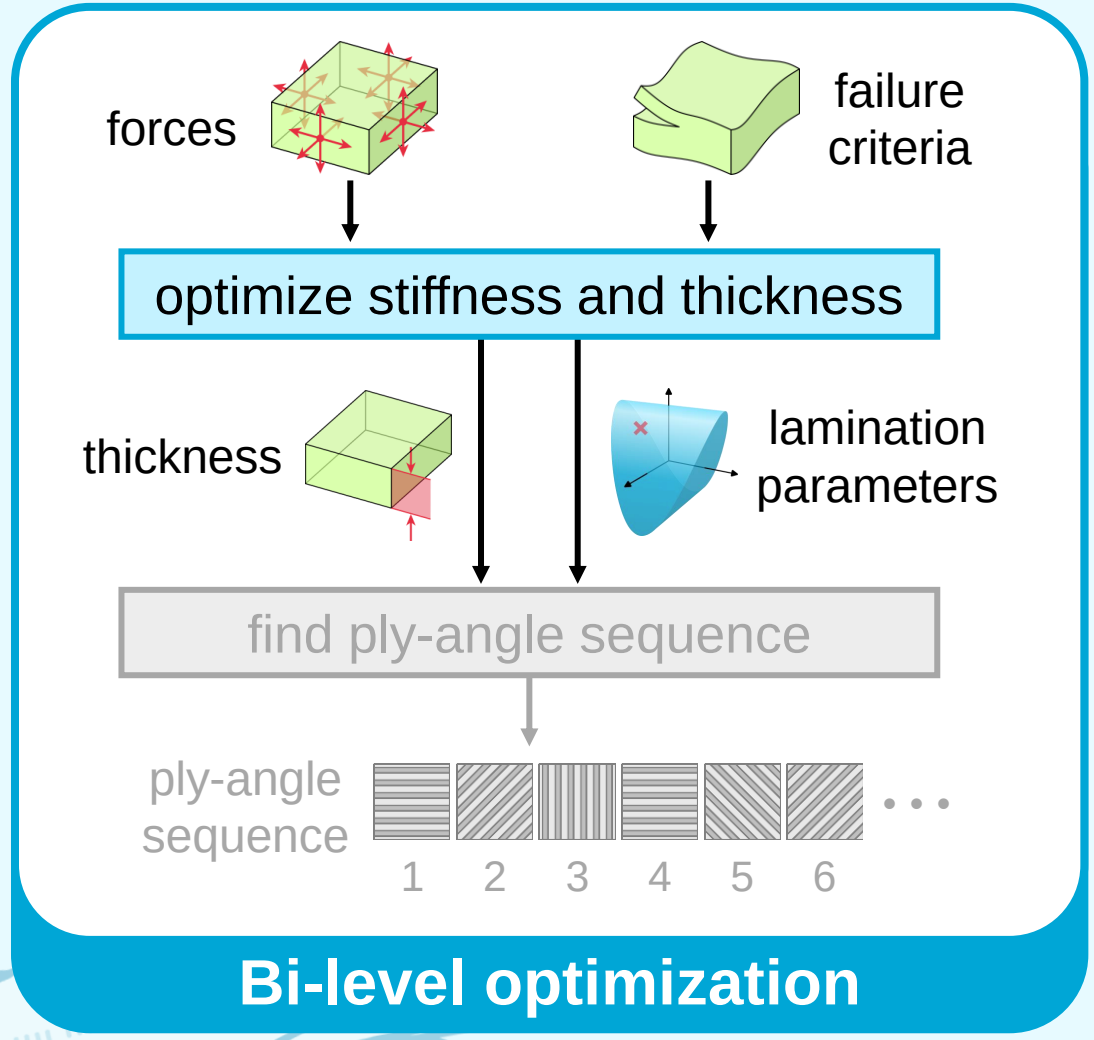


Bi-level optimization

Swapan Madabhushi Venkata
TU Delft

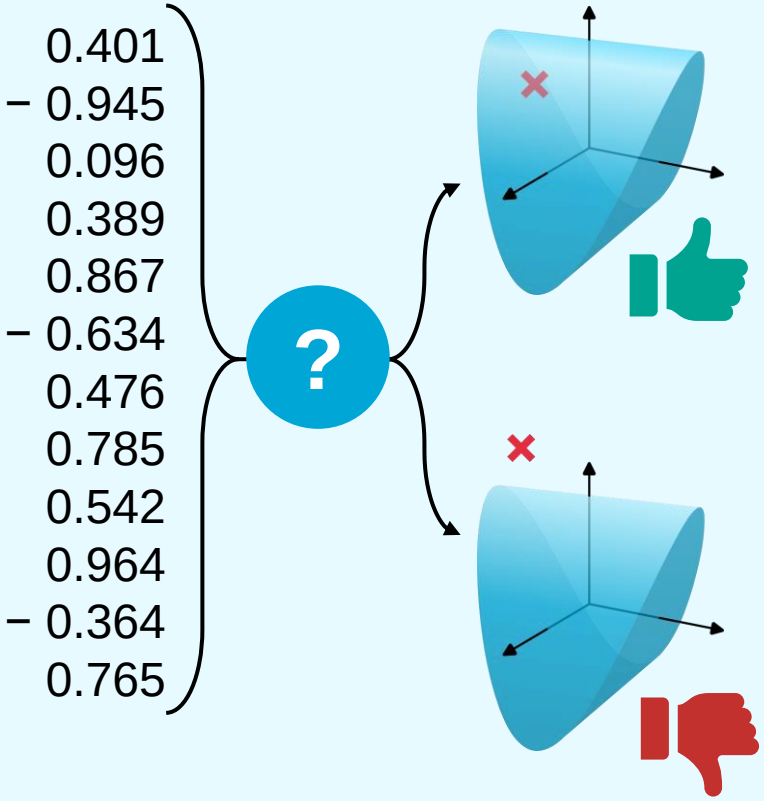
Arne Wulff
TU Delft

optimization of laminated composite materials

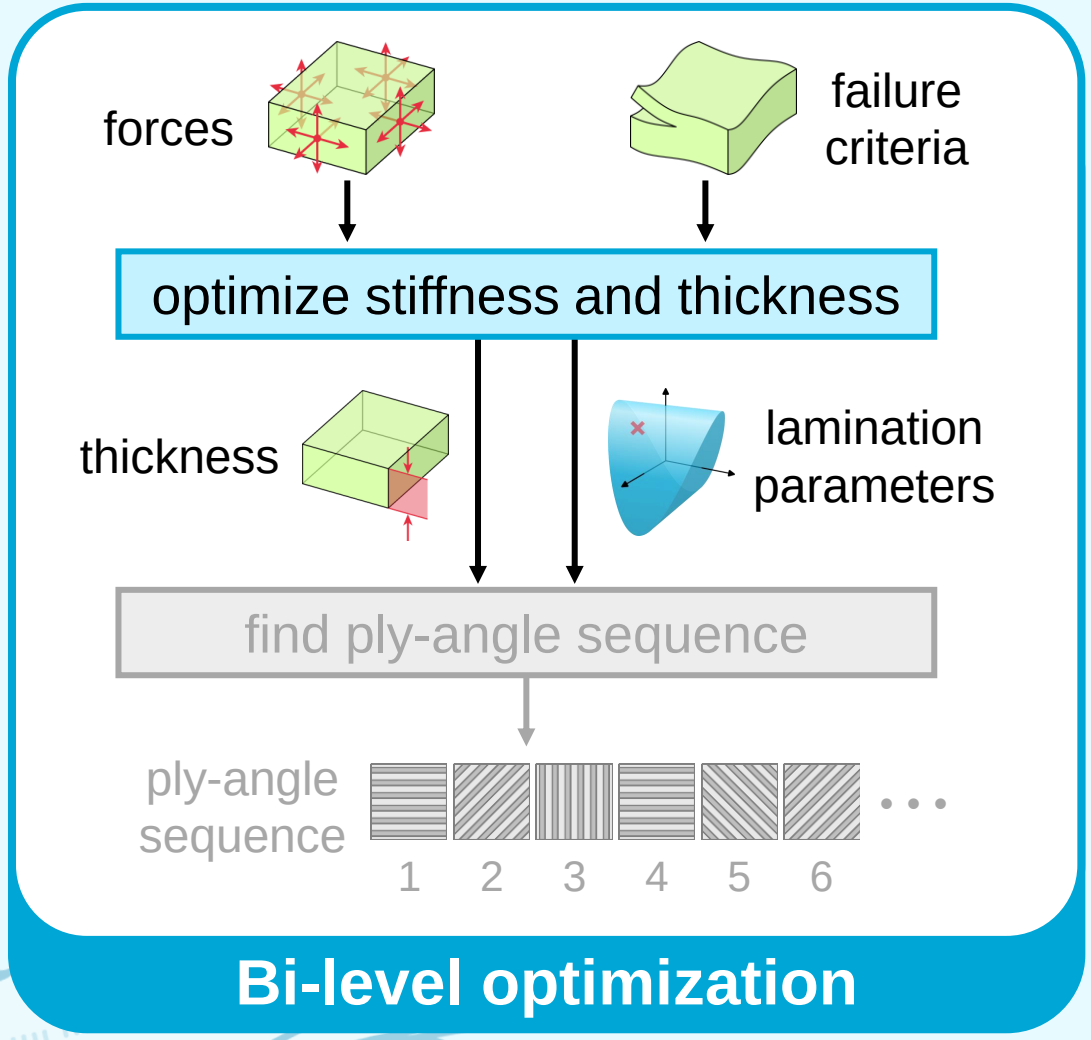


Swapan Madabhushi Venkata
TU Delft

Arne Wulff
TU Delft

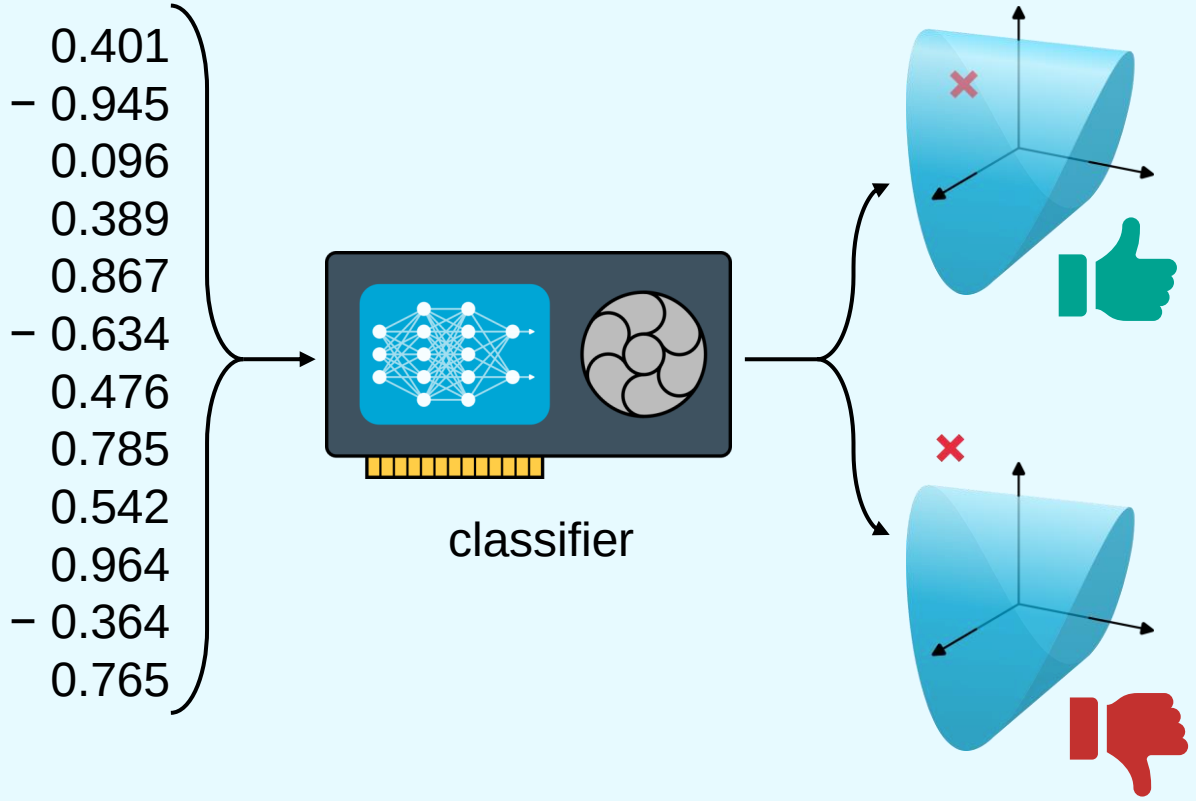


optimization of laminated composite materials

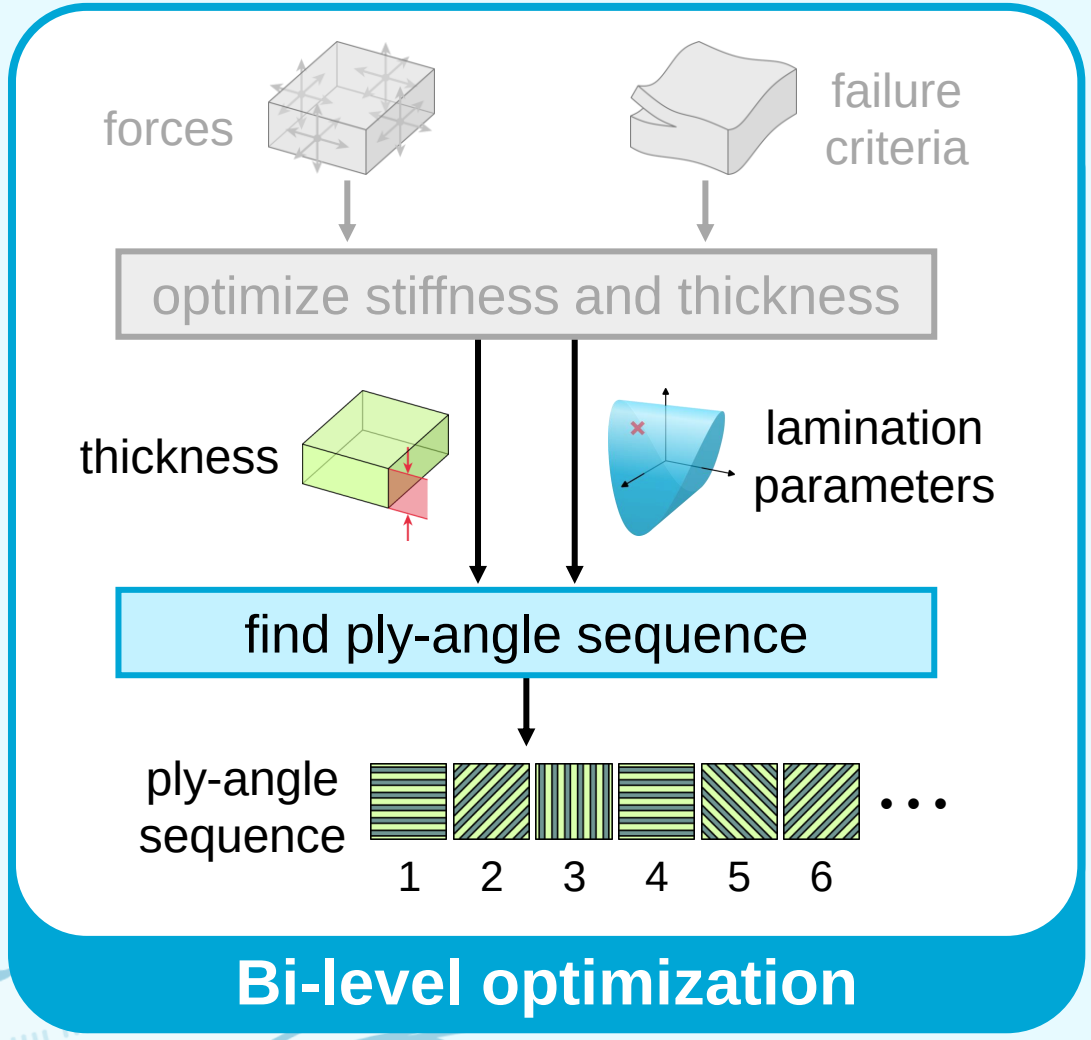


Swapan Madabhushi Venkata
TU Delft

Arne Wulff
TU Delft



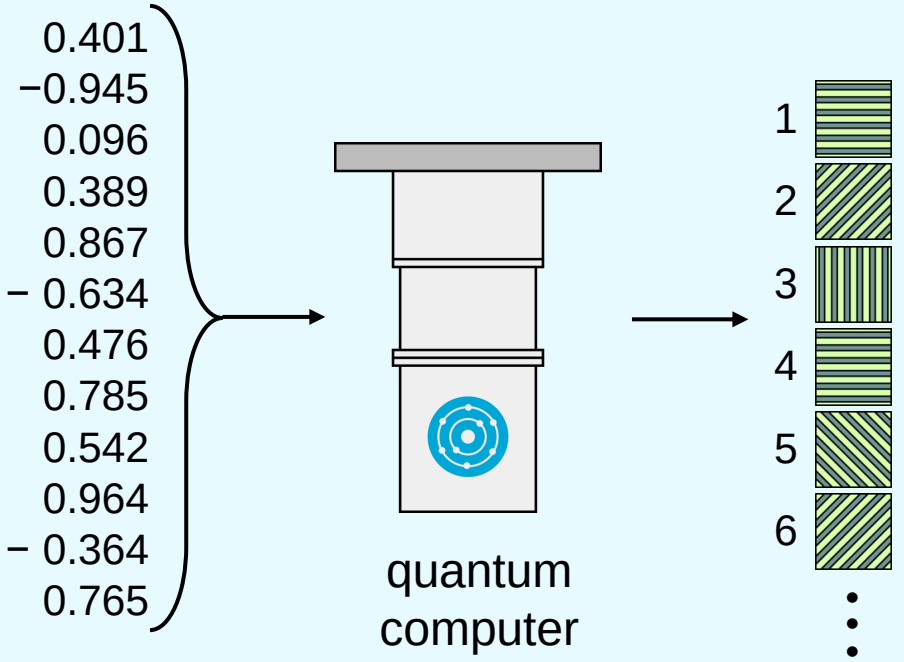
optimization of laminated composite materials



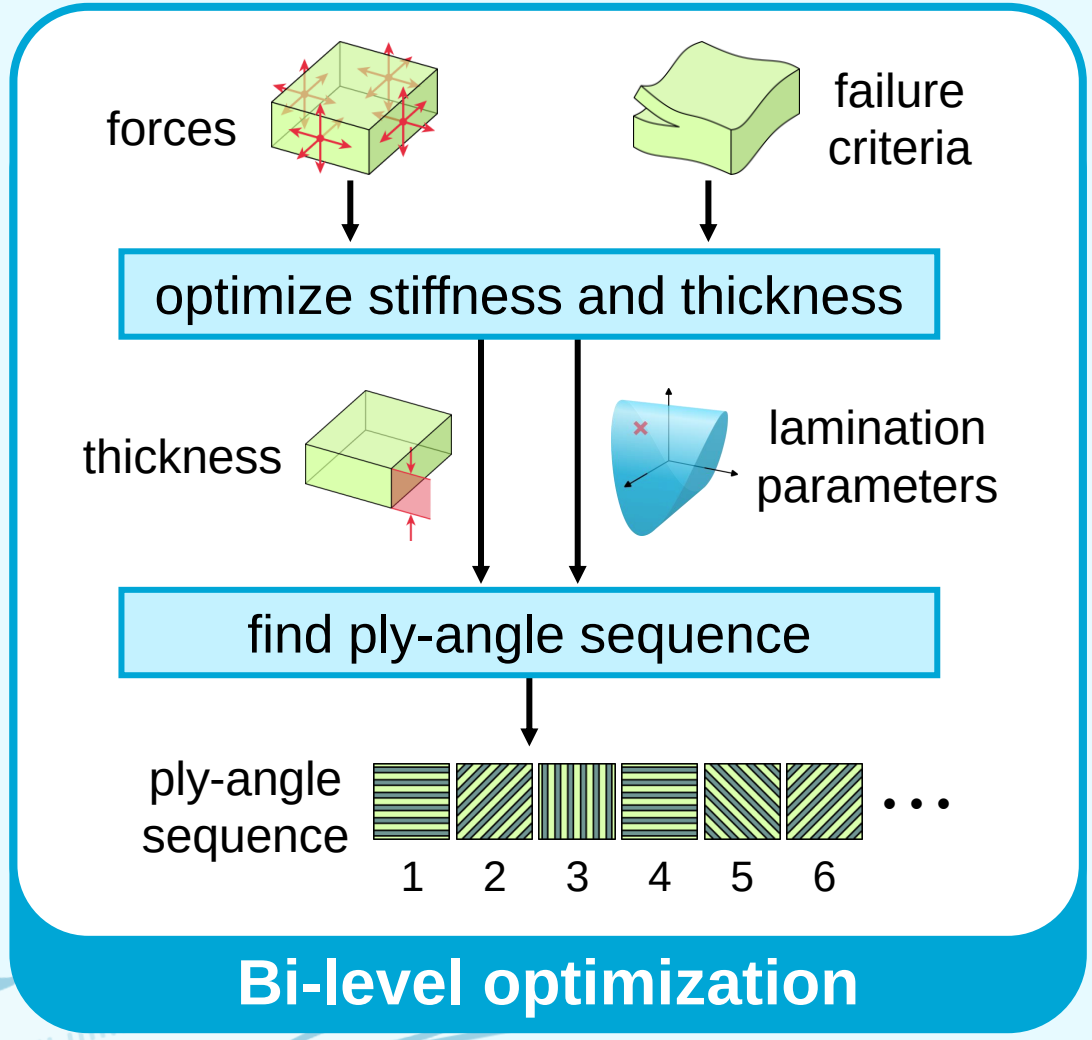
Swapan Madabhushi Venkata
TU Delft

Arne Wulff
TU Delft

combinatorial optimization problem



optimization of laminated composite materials



Swapan Madabhushi Venkata
TU Delft

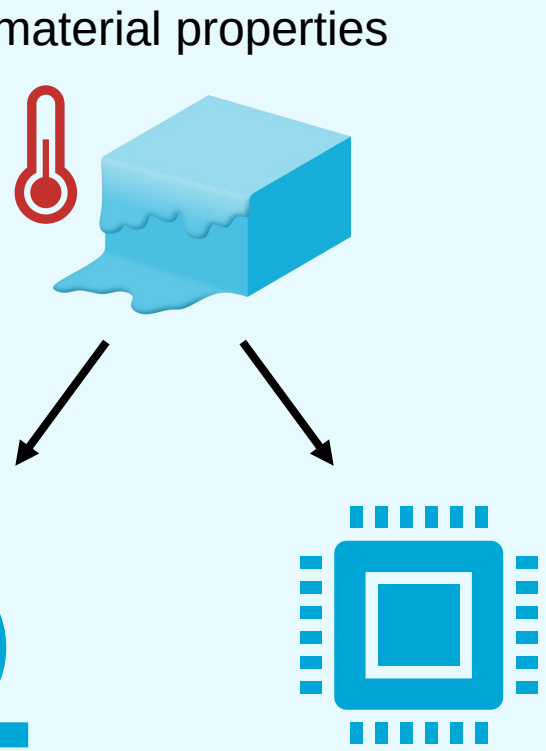
Arne Wulff
TU Delft

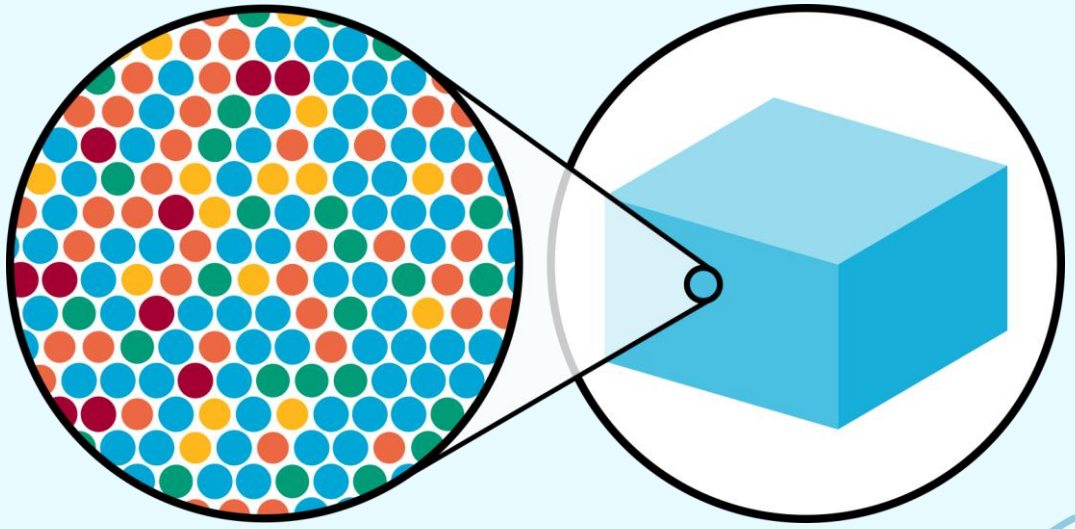
atomistic simulation

at extreme temperatures

Philip Würzner
TU Delft

Koen Mesman
TU Delft





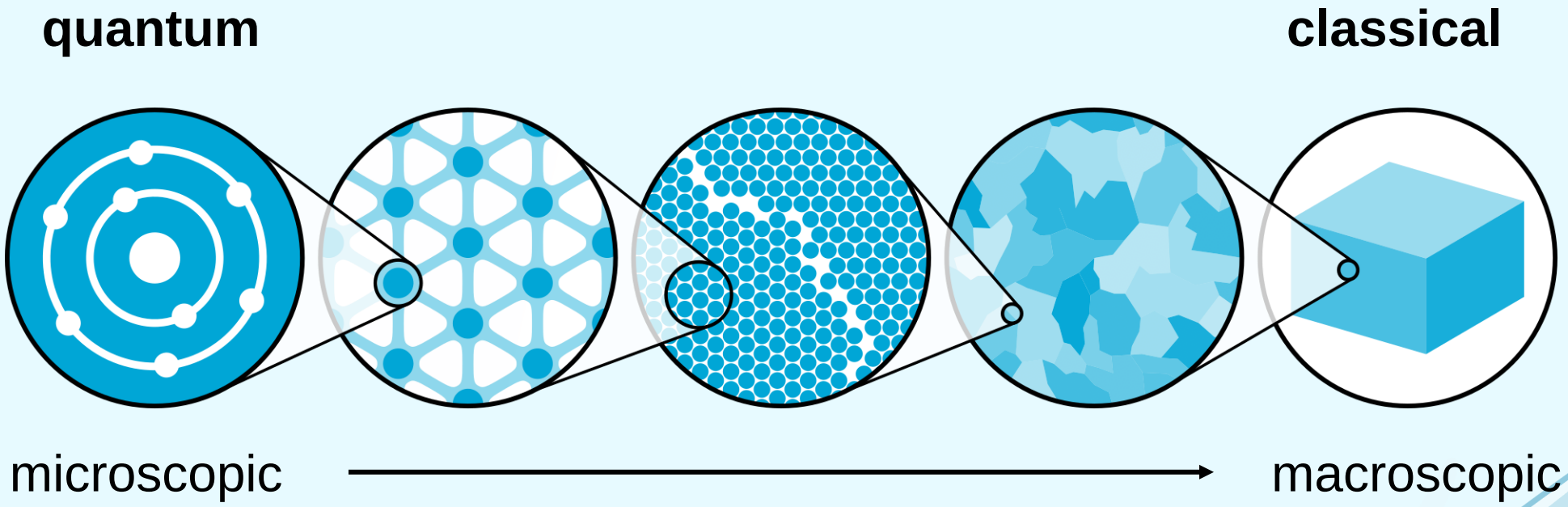
high-entropy materials

atomistic simulation

at extreme temperatures

Philip Würzner
TU Delft

Koen Mesman
TU Delft

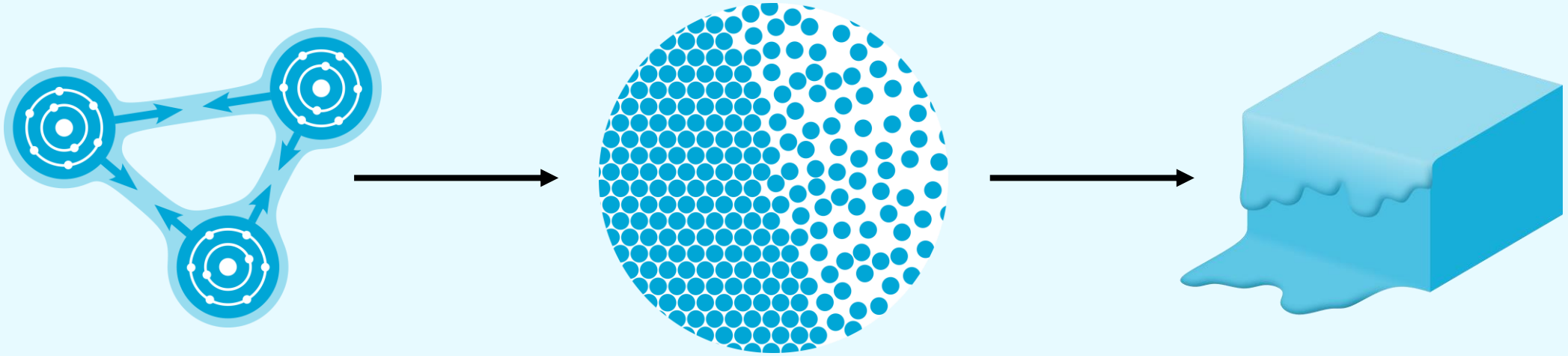


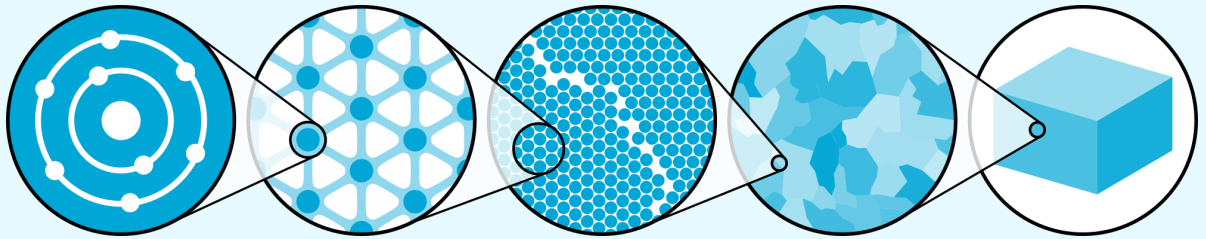
atomistic simulation

at extreme temperatures

Philip Würzner
TU Delft

Koen Mesman
TU Delft



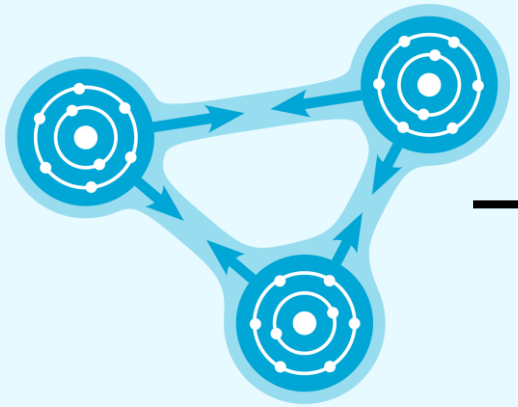


atomistic simulation

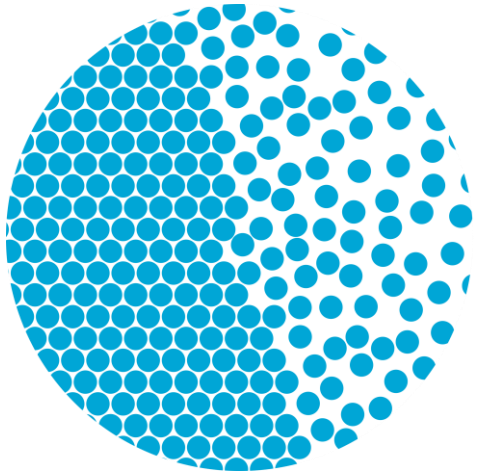
at extreme temperatures

Philip Würzner
TU Delft

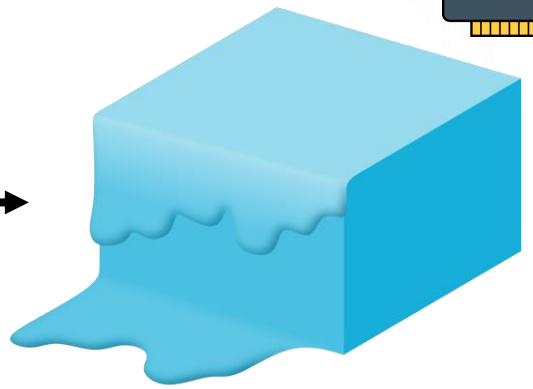
Koen Mesman
TU Delft



Density Functional Theory (DFT)

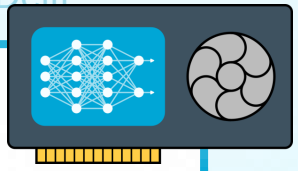


structural stability



melting points

oxidation rates



Improve efficiency of high temperature methodologies

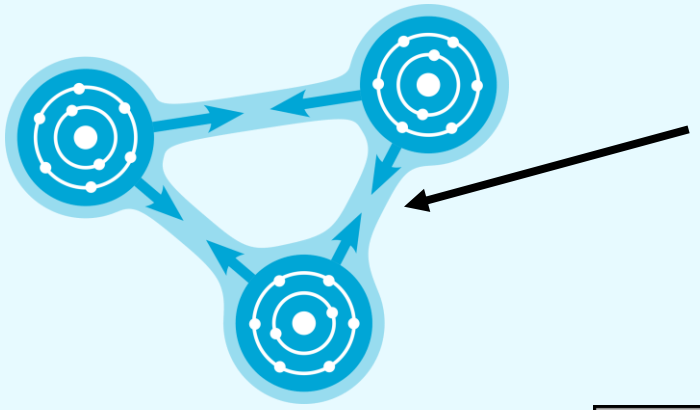
TU Delft | AIMS

atomistic simulation

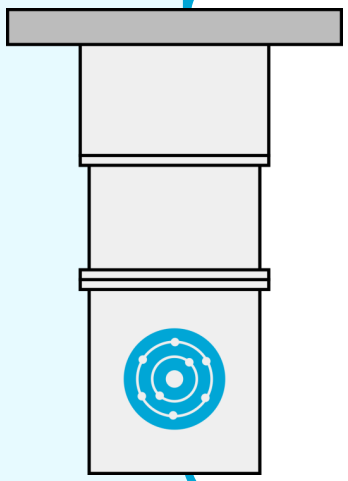
at extreme temperatures

Philip Würzner
TU Delft

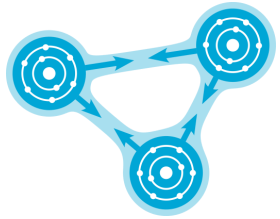
Koen Mesman
TU Delft



interatomic potential



machine learning interatomic potentials



Variational Quantum Eigensolver (VQE)

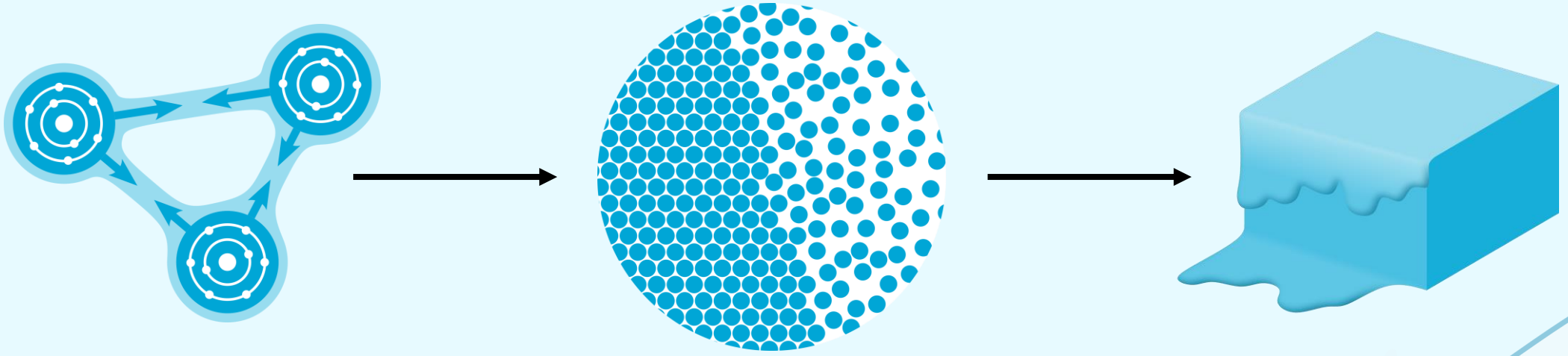
Quantum Neural Networks (QNN)

atomistic simulation

at extreme temperatures

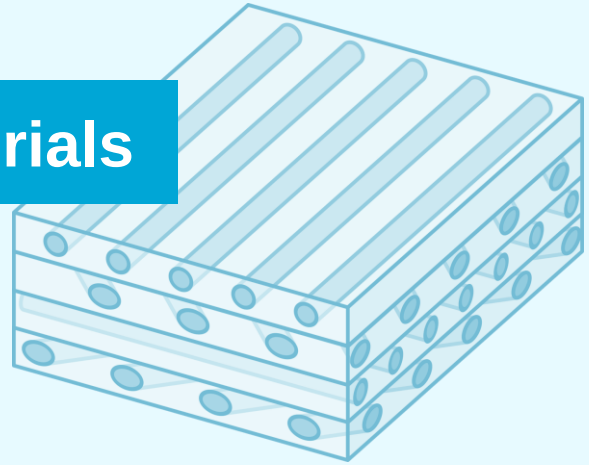
Philip Würzner
TU Delft

Koen Mesman
TU Delft



optimization of

laminated composite materials



Swapan Madabhushi Venkata
TU Delft

Arne Wulff
TU Delft

atomistic simulation

at extreme temperatures

Philip Würzner
TU Delft

Koen Mesman
TU Delft

TU Delft | AIMS

QAIMS

TU Delft

www.tudelft.nl/lr/qaims

Contact:

Dr. Sebastian Feld

S.Feld@tudelft.nl