



Friedrich-Alexander-Universität  
Research Center for  
Mathematics of Data | MoD

## FAU MoD Lecture Series



# Breaking Nonconvexity: Consensus-Based Optimization

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#FAUMoDLecture

### WHEN

Monday **May 11, 2026**  
16:00H (Berlin time)

### WHERE

On-site / Online

Friedrich-Alexander-Universität  
Erlangen-Nürnberg (FAU).  
**Room H13 Johann-Radon-Hörsaal**  
Felix-Klein building  
Cauerstraße 11, 91058  
Erlangen. Bavaria, Germany

Live-streaming:

<https://www.fau.tv/clip/id/63064>

Nonconvex and nonsmooth optimization problems are ubiquitous across science and technology, appearing whenever models must capture complex real-world phenomena involving nonlinear interactions and structural constraints, from the extremely hard problem of protein folding to the computation of optimal operations of (humanoid) robots. Heuristics and local optimization methods are heavily used in practice, with limited success and often no theoretical guarantees. Establishing methods that can provably solve nonconvex optimization would open the door to approaching problems that currently remain inaccessible to rigorous mathematical analysis.

In this lecture we presented results of global convergence for Consensus-Based Optimization (CBO), which is a powerful and versatile zero-order multi-particle method designed to provably solve high-dimensional global optimization problems. The method relies on a balance between stochastic exploration and contraction toward a consensus point, which is defined via the Laplace principle as a proxy for the global minimizer.

We also show how Consensus-Based Optimization is collocated within the global optimization landscape, presenting how it is linked to other methods such as Simulated Annealing, Particle Swarm Optimization, Model Predictive Path Integral, Evolution Strategies. By establishing the bridge between them through CBO, we present novel results of global convergence for all these methods. New groundbreaking results in robotics are presented as an application.