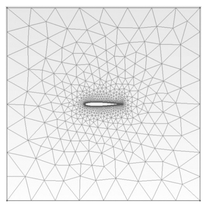
TIARA:
Trustworthy Physics-Informed AI for Aerospace and Transportation

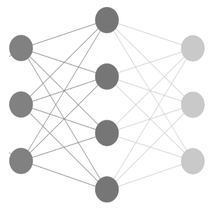
Katharina Rauthmann, Fabrice von der Lehr, Philipp Knechtges
DLR, Institute of Software Technology

Traditional physical approaches to simulation insufficient when

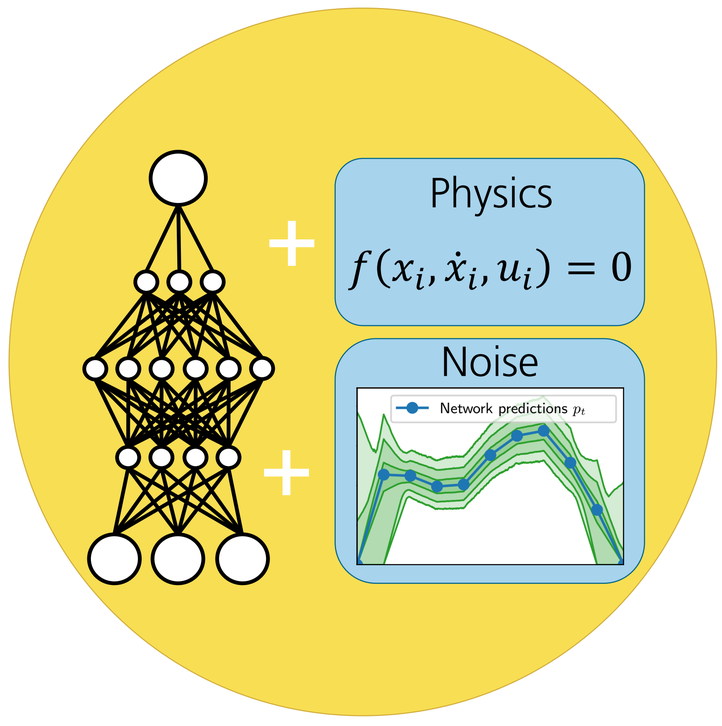


- computing capacity limited
- real-time capability needed

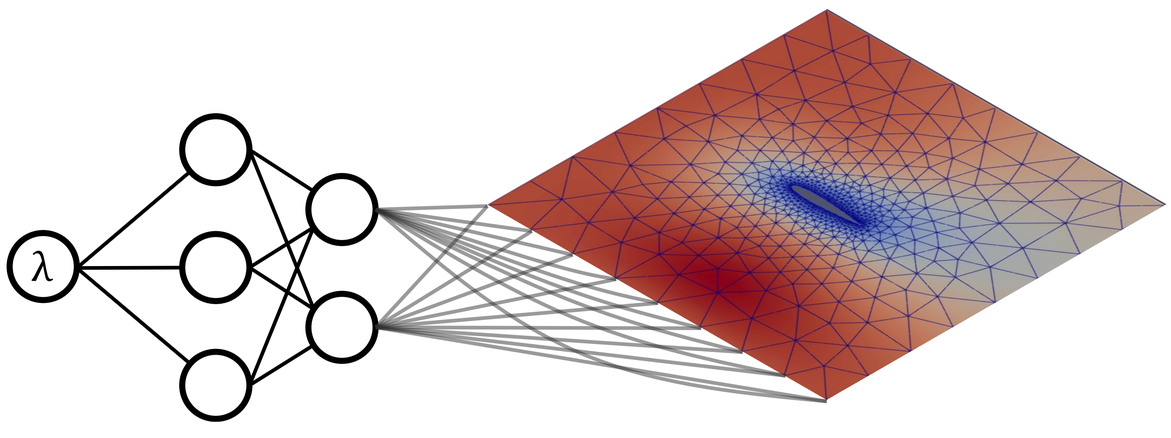
Why are data-driven neural networks not reliable?



- can violate conservation laws
- no information about uncertainties

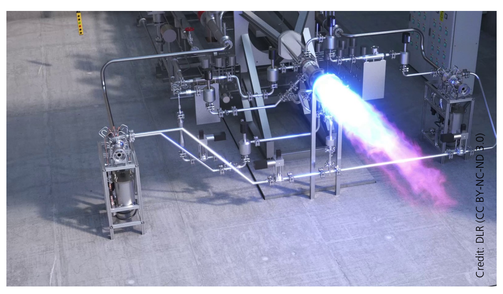


Get the best of both worlds:



Representation of an FEM-based NN learning Stokes flow around an airfoil for different angles of attack λ, mesh and result from [1]

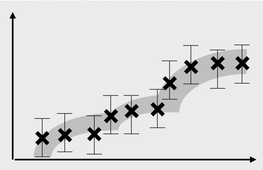
Our applications



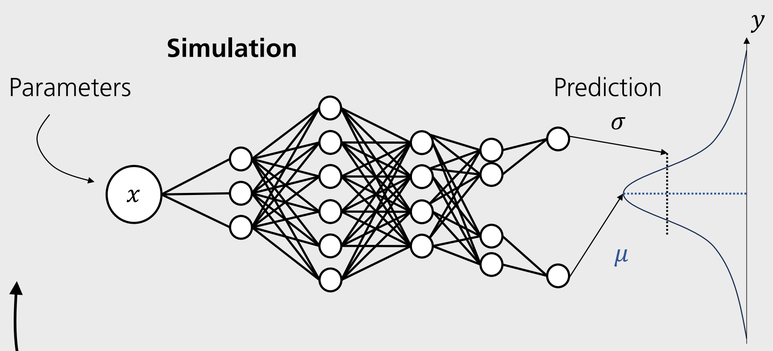
Rocket engine optimal control

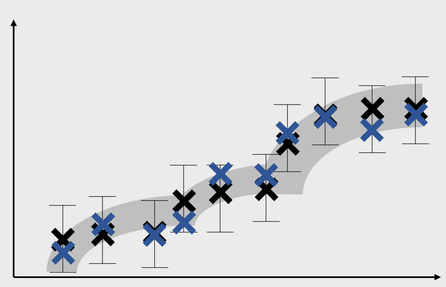
Aircraft rapid design iterations

Data acquisition
Measurements with uncertainties



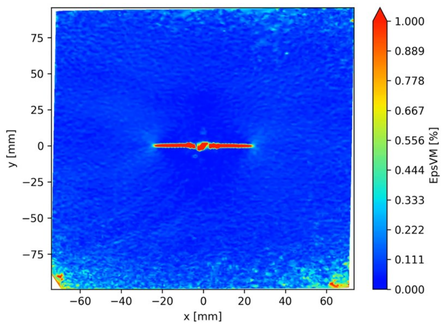
KNOW YOUR SYSTEM
KNOW YOUR RISKS



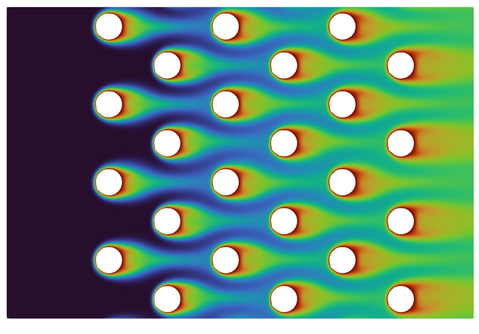


Comparison with measurements

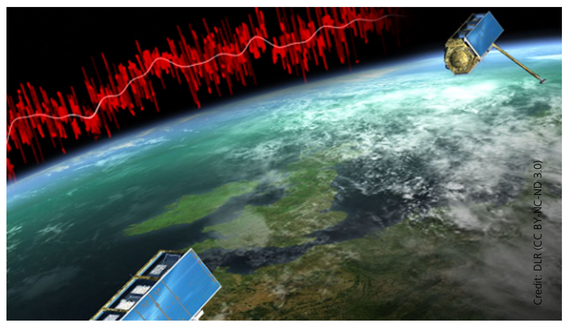
Successful Mission!



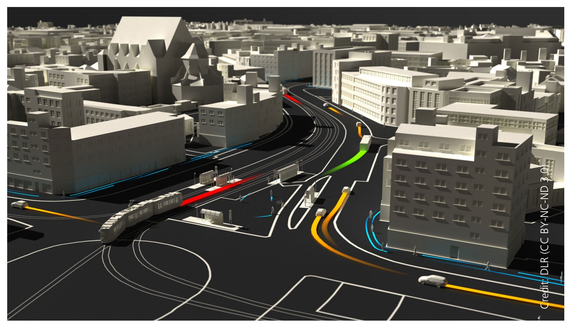
Crack propagation



Flow fields in cooling ducts



Satellite telemetry prediction



Autonomous driving

Participating Institutes:
Institute of Aerodynamics and Flow Technology (AS)
Institute of Electrified Aero Engines (EL)
Institute for AI Safety and Security (KI)
Institute of Space Propulsion (RA)
Space Operations and Astronaut Training (RB)
Institute of Software Technology (SC)
Institute for Frontier Materials on Earth and in Space (FM)

Reference:
[1] Griese, Franziska, et al. "Preconditioned FEM-based neural networks for solving incompressible fluid flows and related inverse problems." Journal of Computational and Applied Mathematics 469 (2025): 116663.

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