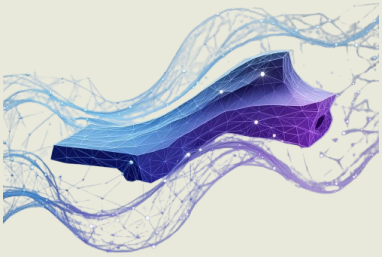
Gradient Dynamics

MESHING AND MULTIPHYSICS SIMULATION

Gradient Dynamics provides cutting-edge cloud-based solutions for meshing and multiphysics simulation. Our platform empowers engineers and researchers to tackle complex challenges with unparalleled speed, scalability, and accuracy. This white paper outlines the key capabilities of our integrated platform, designed to accelerate innovation and optimize product performance.

Meshing Overview



The meshing engine is built on an octree-based, hex-dominant algorithm with structured prism layers. It produces high-quality meshes with excellent orthogonality and controlled aspect ratios, suitable for both pressure- and density-based CFD solvers.

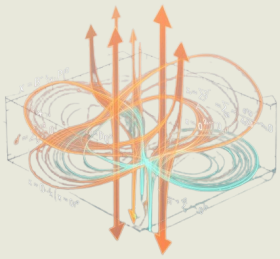
The platform automates boundary layer generation, multi-region domain setup, and rotating zones, while an AI-driven agent adjusts parameters based on geometry and application. Users upload CAD or STL files, select the simulation type, and receive validated, solver-ready meshes in standard export formats including Fluent, OpenFOAM, and STAR-CCM+.

Running entirely in the cloud, the system removes hardware and installation constraints. It adapts to a wide range of workflows such as vehicle aerodynamics, cooling system design, turbomachinery, and thermal analysis, delivering consistent, production-quality results at scale.

Key Capabilities

- [ ] Octree-based hex-dominant meshing with adaptive local refinement.
- [ ] Structured prism layers with control over first cell height and growth rate.
- [ ] Automatic boundary layer trimming and self-intersection handling.
- [ ] Multi-region and rotating zone support with conformal interface management.
- [ ] AI-assisted meshing parameter selection.
- [ ] Quality checks for skewness, orthogonality, and aspect ratio.
- [ ] Exports for major solvers (Fluent, OpenFOAM, CGNS, STAR-CCM+, SU2, VTU/VTK).
- [ ] GPU-accelerated, cloud-native operation for large or complex models.

Multiphysics Simulation



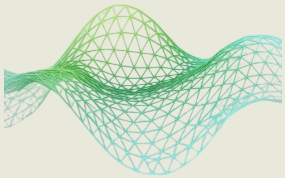
The Gradient Dynamics simulation platform builds on this foundation to deliver full multiphysics capability. Its GPU-native solvers enable fast, iterative analysis of coupled fluid, thermal, and structural problems, making simulation a practical part of the design process rather than a separate post-analysis step.

Designed for applications in electronics cooling, aerospace, and energy systems, the platform supports parallel simulations without hardware or licensing constraints. Built-in optimization and differentiable solvers give engineers direct access to design sensitivities for advanced modeling and performance enhancement.

Key Capabilities

- [ ] GPU-native solvers for rapid turnaround.
- [ ] Coupled CFD, heat transfer, and structural mechanics in one environment.Accurate conjugate heat transfer and turbulence modeling (RANS, LES).
- [ ] Unstructured mesh compatibility for complex geometries.
- [ ] Direct parametric geometry linking for automated iterations.
- [ ] Integrated design optimization and AI workflow support.
- [ ] Differentiable architecture enabling gradient-based analysis.
- [ ] Fully cloud-native deployment with scalable compute resources.

Summary



Gradient Dynamics offers a cloud-native environment for meshing and multiphysics simulation that brings together automation, computational speed, and scalability. By integrating mesh generation, solver execution, and optimization within a single workflow, the platform simplifies the entire simulation process from geometry import to performance evaluation. Its GPU-accelerated architecture and AI-assisted tools enable engineers and researchers to model complex systems, explore design alternatives efficiently, and make data-driven design decisions with confidence.