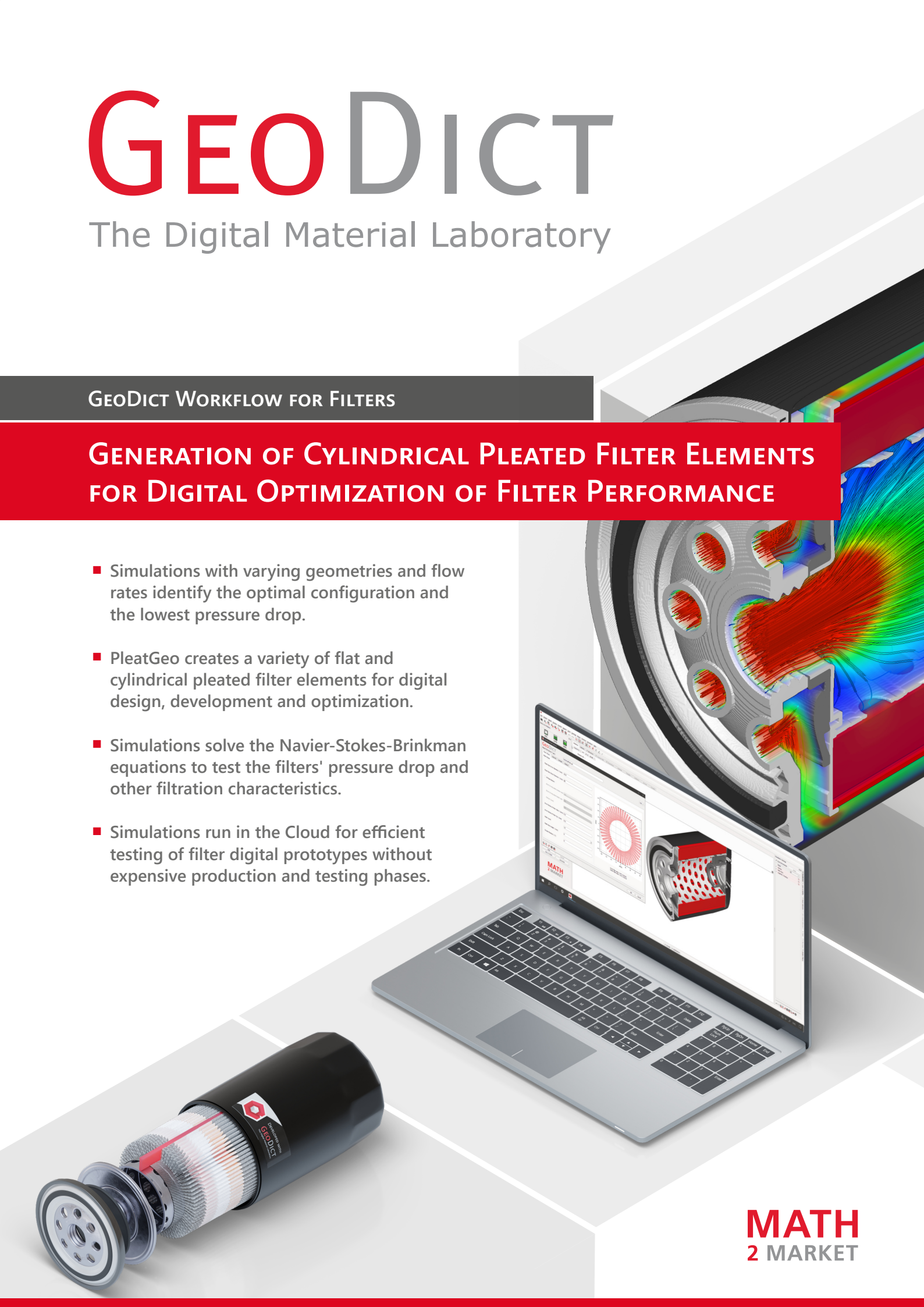
GeoDict

The Digital Material Laboratory

GeoDict Workflow for Filters

Generation of Cylindrical Pleated Filter Elements for Digital Optimization of Filter Performance

- Simulations with varying geometries and flow rates identify the optimal configuration and the lowest pressure drop.
- PleatGeo creates a variety of flat and cylindrical pleated filter elements for digital design, development and optimization.
- Simulations solve the Navier-Stokes-Brinkman equations to test the filters' pressure drop and other filtration characteristics.
- Simulations run in the Cloud for efficient testing of filter digital prototypes without expensive production and testing phases.



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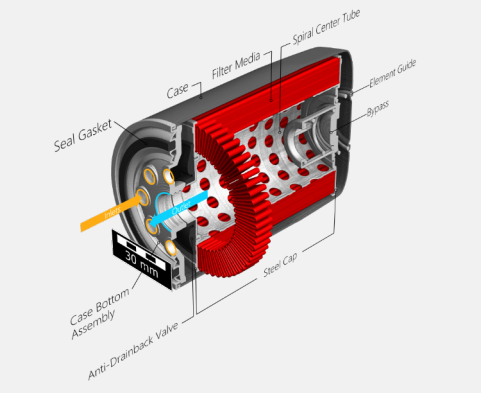
GeoDict Workflow for Digital Filter Development

1 Import of CAD geometry

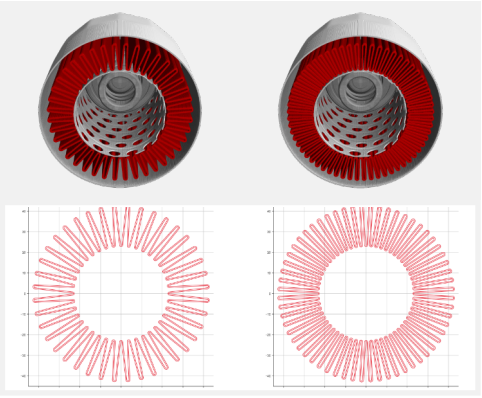


Import a CAD model (e.g. an oil filter) into GeoDict using the ImportGeo-CAD module

- Assign different material parameters to each material ID through the built-in GeoDict material database
- Specify inlets, outlets, and fluid
- GeoDict returns feedback on watertightness of geometry
- Geometry can be sealed with built-in functions if not entirely watertight

Result: Digital twin/structure of the filter

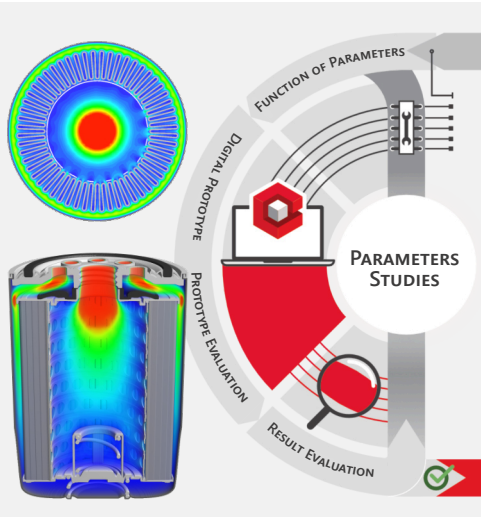
2 Digital Development

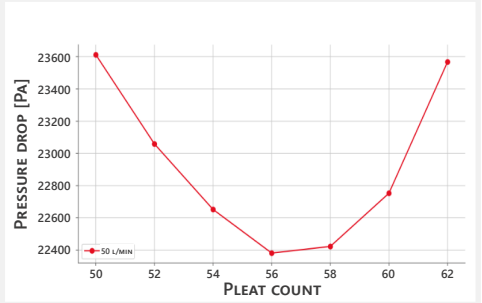


- Generate several pleat count configurations using the PleatGeo module to create cylindrical pleats
- Combine original filter housing geometry and newly designed pleat geometry into digital prototype
- Input parameters include: inner and outer diameter, pleat count, height of the pleats, and inner radius at pleat valley and tip
- Use several sets of digitally-generated pleated filter media

Result: Digital prototype of a filter

3 Performance analysis





- Perform systematic tests or optimize filter flow performance by finding local minimum of pressure drop or effects of specific parameters on the filter performance
- Use the FlowDict module to compute pressure and velocity distributions with the LIR solver
  - LIR solver applies adaptive meshing and uses multigrid and Krylov solving schemes
- Test and optimize flow performance by carrying out large parametric studies applying Python scripts within GeoPy and by using the cloud computation capabilities of GeoDict.
- Simulations shown here were performed using 16 core workstation and took approximately 67 GB of RAM and 1.4 hours each.

Result: Improved filter configuration for experimental validation at the testbench

Math2Market GmbH | Richard-Wagner-Str. 1 | 67655 Kaiserslautern, Germany
☎ +49 631 205 605 0 +49 631 205 605 99 filtration@math2market.de
www.GeoDict.com

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