NUMERICAL PREDICTION FOR PERMEABILITY OF WOVEN FABRICS

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GOAL

- The purpose of this research is to predict the permeability of complex fabrics at different fiber volume fractions.
- This can be accomplished by modeling resin flow through geometric model of reinforcement.
- In computer simulations one can modify fiber volume fraction or fabric geometry to estimate the effects on fabric permeability.
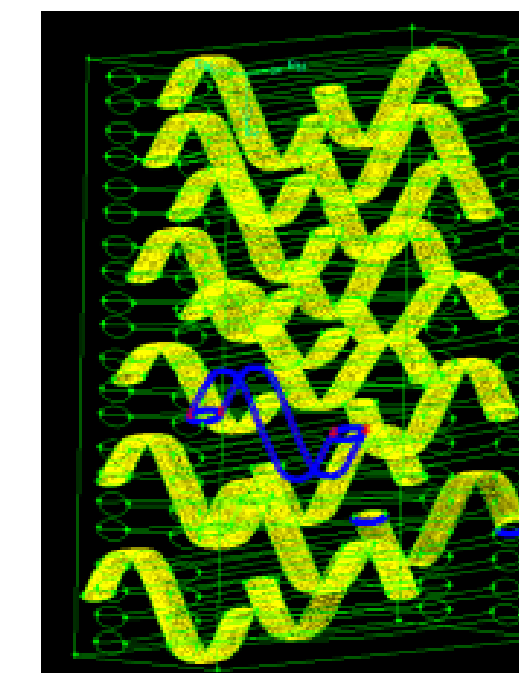

SOLID MODELING

- V-Systems Composites sends multiple files containing models of fabrics to be analyzed.
- The files are imported and manipulated so each wall is identical to its parallel wall.
- This makes it possible to see the change in long distances and only modeling small units.
- Then they are turned into meshes and are exported into Fluent.
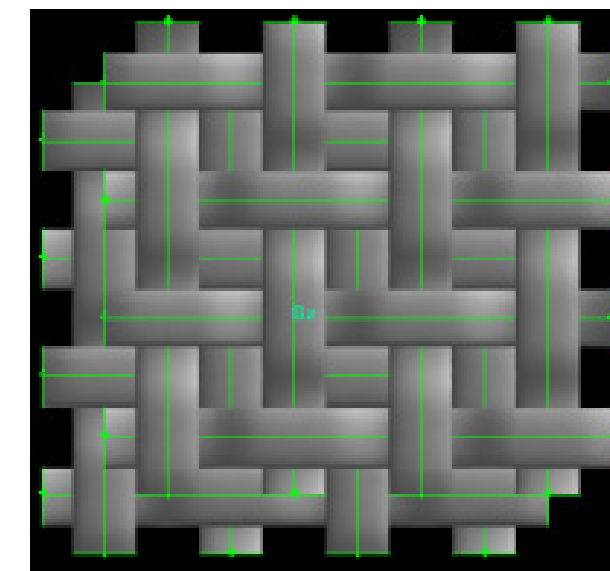
Solid Model   Mesh

FLUENT

- Fluent is used to simulate the resin flowing through the meshes and then reports the mass flow rates.
- Settings such as viscosity, periodicity, and pressure gradient must be altered for each test.
- The pressure gradient is due to the resistance of the liquid flowing through the mesh.
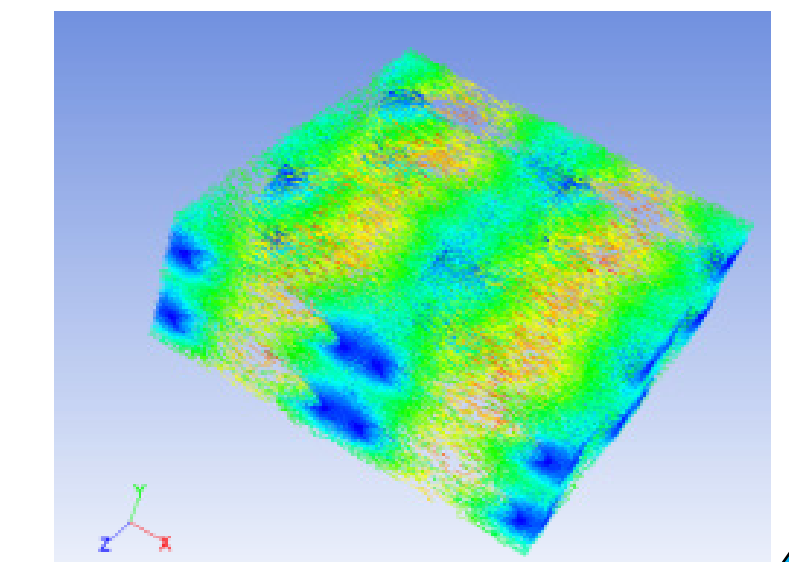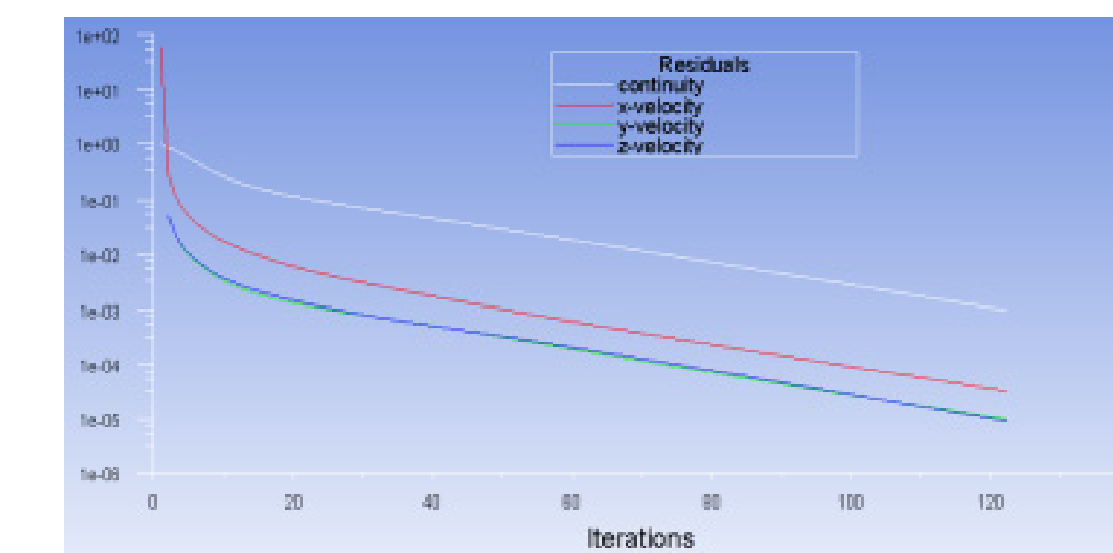
CALCULATIONS

- With the mass flow rate the permeability can be found.

$$K = \frac{M^\circ * A * \mu}{\Delta P * \rho}$$
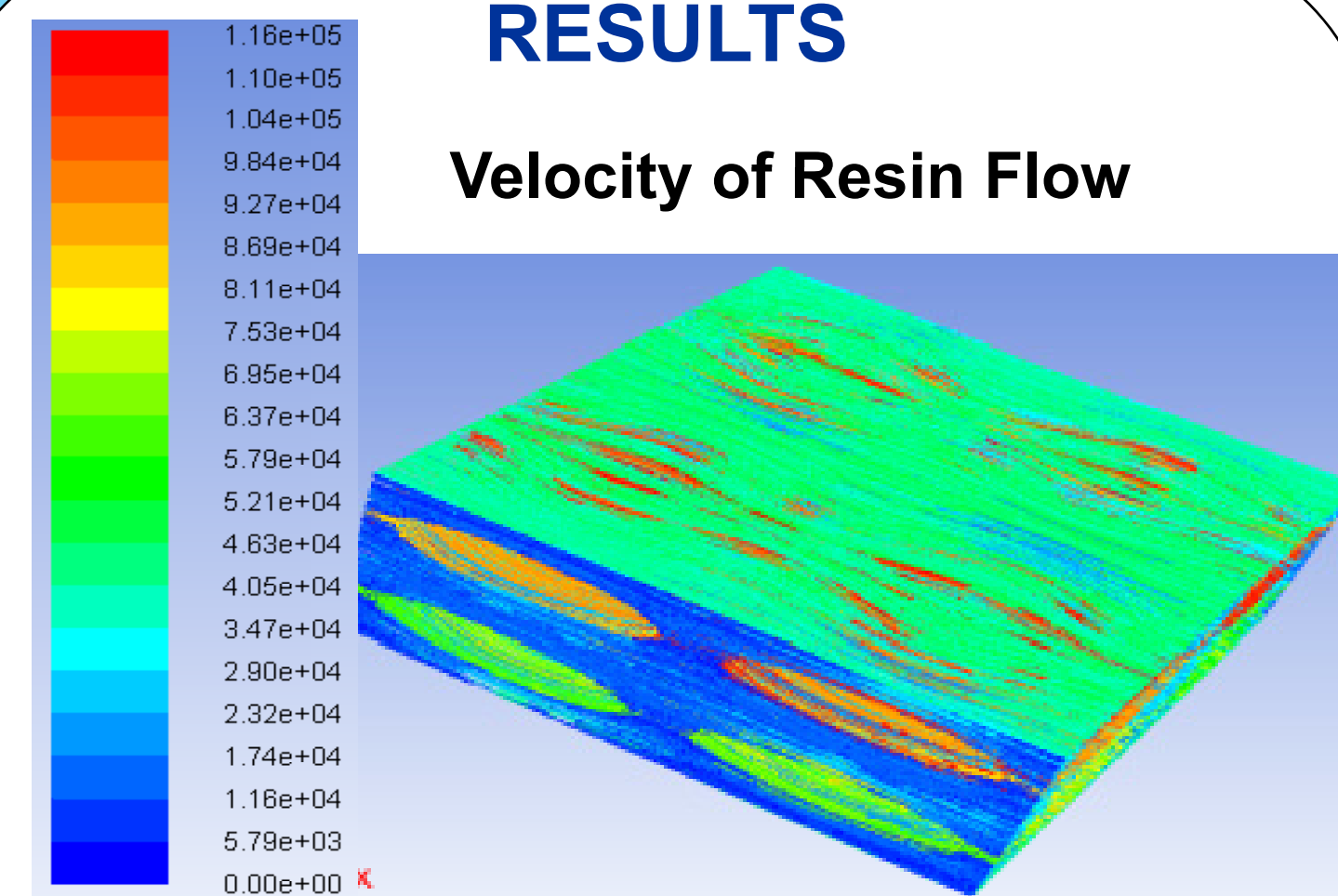
$M^\circ = mass\ flow\ rate \quad A = area$

$\rho = density \quad K = permeability$

$\Delta P = Change\ in\ Pressure\ per\ length$

$\mu = viscosity$

RESULTS

Velocity of Resin Flow

Fiber tow layers	K
1	6.94E-12
2	5.18E-13
3	3.01E-22

FUTURE PLANS

- Next thing to do is take new meshes and run the simulations.
- Then make actual models of the fabrics and compare the test permeability against the simulated permeability.

ACKNOWLEDGEMENTS