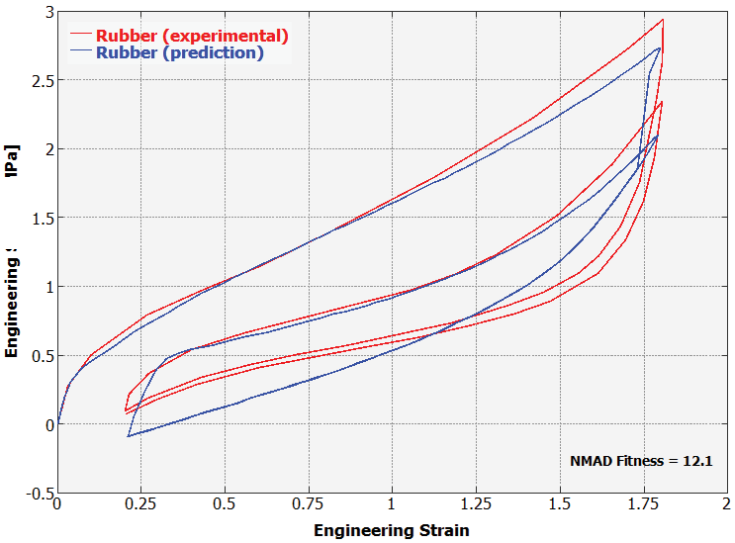
# Reinforced Hose Analysis

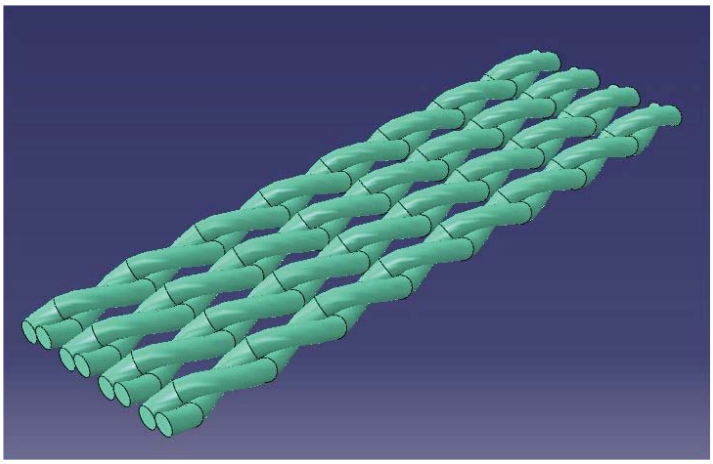
## The Challenge

A high-strength reinforced hose failed in service under normal operating conditions well before its intended design life. Inspections of the subject hose revealed that failure was mainly due to delamination.

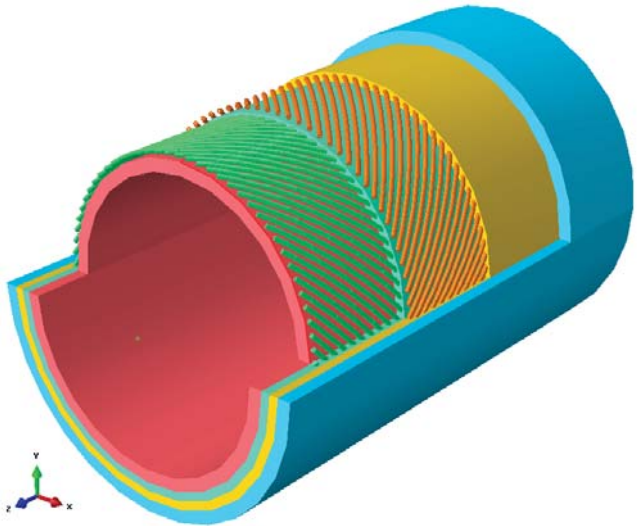
The hose elongation response, internal stresses, and torque balance were critical in identifying the cause of delamination and, ultimately, in redesigning the hose to meet performance requirements.




*Calibration of material model to experimental stress-strain data*



*Micro-scale model of reinforcement layer in hose*



*Macro-scale modeling of hose and reinforcement layers*

## Veryst's Approach

In spite of the complex, composite design of the hose, initial modeling was primarily analytical in nature, and assumed hyperelasticity of the elastomer matrix materials. Veryst experimentally measured the stress-strain data for these materials and found that such models were inadequate, and instead *calibrated proprietary material models that more closely matched the experimental data*.

Veryst further developed a multi-scale finite element model to evaluate not only the global elongation response, torque balance, effect of internal fluid, and load-carrying capacity of the hose but also the microscale behavior around individual fibers. This allowed Veryst to *identify operating conditions under which delamination, bulging, and rupture were likely to occur*.

## Project Outcome

As a result of Veryst's work, the client was able to quickly evaluate alternative hose designs and come up with more accurate performance specifications. Veryst's finely tuned material models and multi-scale finite element analyses allowed the client to optimize their design with confidence and identify potential failure modes without costly and time-consuming prototyping and testing of candidate designs.

Veryst Engineering 47A Kearney Road Needham, MA 02494 Phone 781.433.0433 Fax 781.433.0933 www.veryst.com