Accurate Finite Element Analysis over a Tangled Mesh

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The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a simple method to improve design testing by allowing finite element analysis to be carried out over a tangled mesh.

OVERVIEW

Finite element analysis (FEA) is a software modeling tool that allows engineers and designers to break down complex problems into a limited number of simpler ones. In this way, a user is able to verify that a proposed product design or refinement will perform to specifications prior to prototyping.

In FEA, the geometry of the proposed design is identified and broken up into a mesh or grid representation. The mesh is made up of finite elements defined by shapes and nodes. Boundary conditions (like stress, constraints or loads) are applied to determine how the nodes get displaced. This helps calculate real-world stresses and strains.

Critically, if any of the elements overlap, then invalid solutions will result. In other words, the mesh must not be ‘tangled.’ Unfortunately, most FEA systems inevitably produce tangled meshes and untangling them consumes time and resources. An alternative approach clearly is needed.

THE INVENTION

UW–Madison researchers have developed a method for carrying out FEA over a tangled mesh. The process involves the step of meshing a domain under a field of multiple finite elements. ‘Stiffness contributions’ are computed, both for the finite elements as well as for overlaps. The two calculations are combined and used to generate valid solutions to the proposed design equations.

APPLICATIONS

• FEA software
KEY BENEFITS

• Simple and inexpensive to implement
• Generates accurate, physically valid solutions
• No burdensome untangling

ADDITIONAL INFORMATION

Related Technologies
WARF reference number P08425US describes a method for automated analysis of thin structures to enhance 3-D modeling software.
WARF reference number P06166US describes a method for estimating the effects of large design changes to prior simulation results.

Tech Fields
Information Technology - Software

CONTACT INFORMATION

For current licensing status, please contact Emily Bauer at emily@warf.org or 608-960-9842.