

Predict failure index and strength ratio of a honeycomb sandwich plate

Problem Description

The failure index and strength ratio of a honeycomb sandwich plate under the biaxial loading condition are predicted using the MSG plate model. For a plate structural analysis, the loads are usually expressed in terms of plate stress resultants $\{N_{11}, N_{22}, N_{12}, M_{11}, M_{22}, M_{12}\}$. In this example, $N_{11}=N_{22}=10$ N is assumed.

Software Used

[Gmsh4SC 2.0](#)

Solution Procedure

Below describes the step-by-step procedure you followed to solve the problem.

1. step 1

- Open Gmsh4SC and create a new model (Change the default name). Click Material->Thermoelastic and input the matrix and fiber properties as shown in Fig. 1 and Fig. 2.



Material Properties

Isotropic | Orthotropic | Anisotropic

Material ID number: 1 | Material Name: core

E: 4200 | nu: 0.34

rho: 0 | Ti: 0

alpha: 0 | Ce: 0

Add | Exit

Fig. 1

▲Material Properties

IsotropicOrthotropicAnisotropic

2

Material ID number

lam

Material Name

140e3

E1

10e3

E2

10e3

E3

5e3

G12

5e3

G13

3e3

G23

0.25

v12

0.25

v13

0.26

v23

0

rho

0

Ti

0

alpha11

0

alpha22

0

alpha33

0

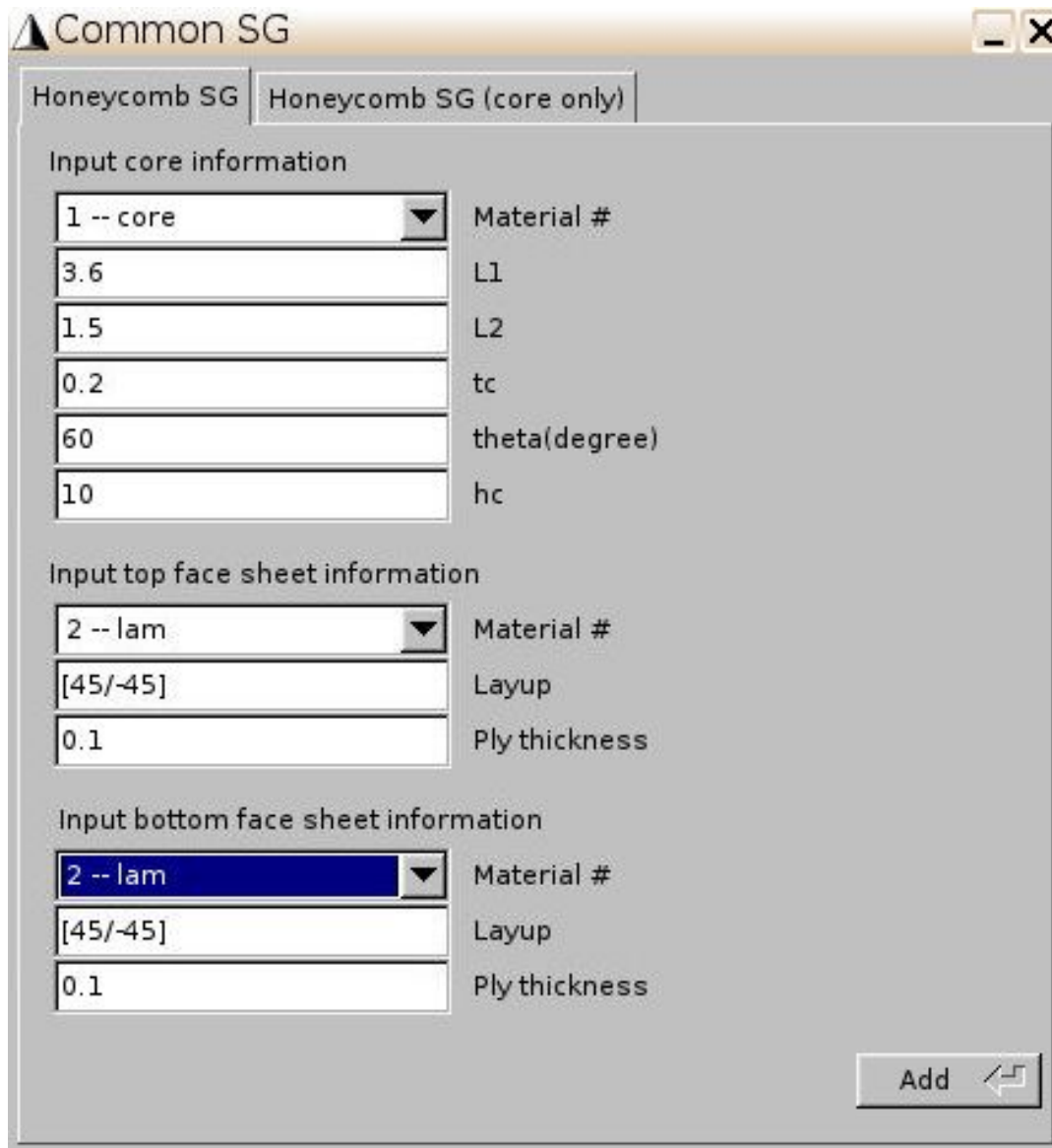
Ce

Add

Exit

Fig. 2

* Click Geometry->Common SG-> 3D SG->Honeycomb. Select the materials for core and skim as shown in Fig. 3.



The image shows a software dialog box titled "Common SG". It has two tabs: "Honeycomb SG" (selected) and "Honeycomb SG (core only)". The dialog is divided into three sections for inputting core, top face sheet, and bottom face sheet information. Each section contains a dropdown menu for material selection and several text input fields for material properties. An "Add" button with a right-pointing arrow is located at the bottom right.

Section	Field	Value	Label
Input core information	Material #	1 -- core	Material #
	L1	3.6	L1
	L2	1.5	L2
	tc	0.2	tc
	theta(degree)	60	theta(degree)
	hc	10	hc
Input top face sheet information	Material #	2 -- lam	Material #
	Layup	[45/-45]	Layup
	Ply thickness	0.1	Ply thickness
Input bottom face sheet information	Material #	2 -- lam	Material #
	Layup	[45/-45]	Layup
	Ply thickness	0.1	Ply thickness

Buttons: Add

Fig. 3

* Click Mesh->Generate 3D mesh->Generate (Fig. 4.).

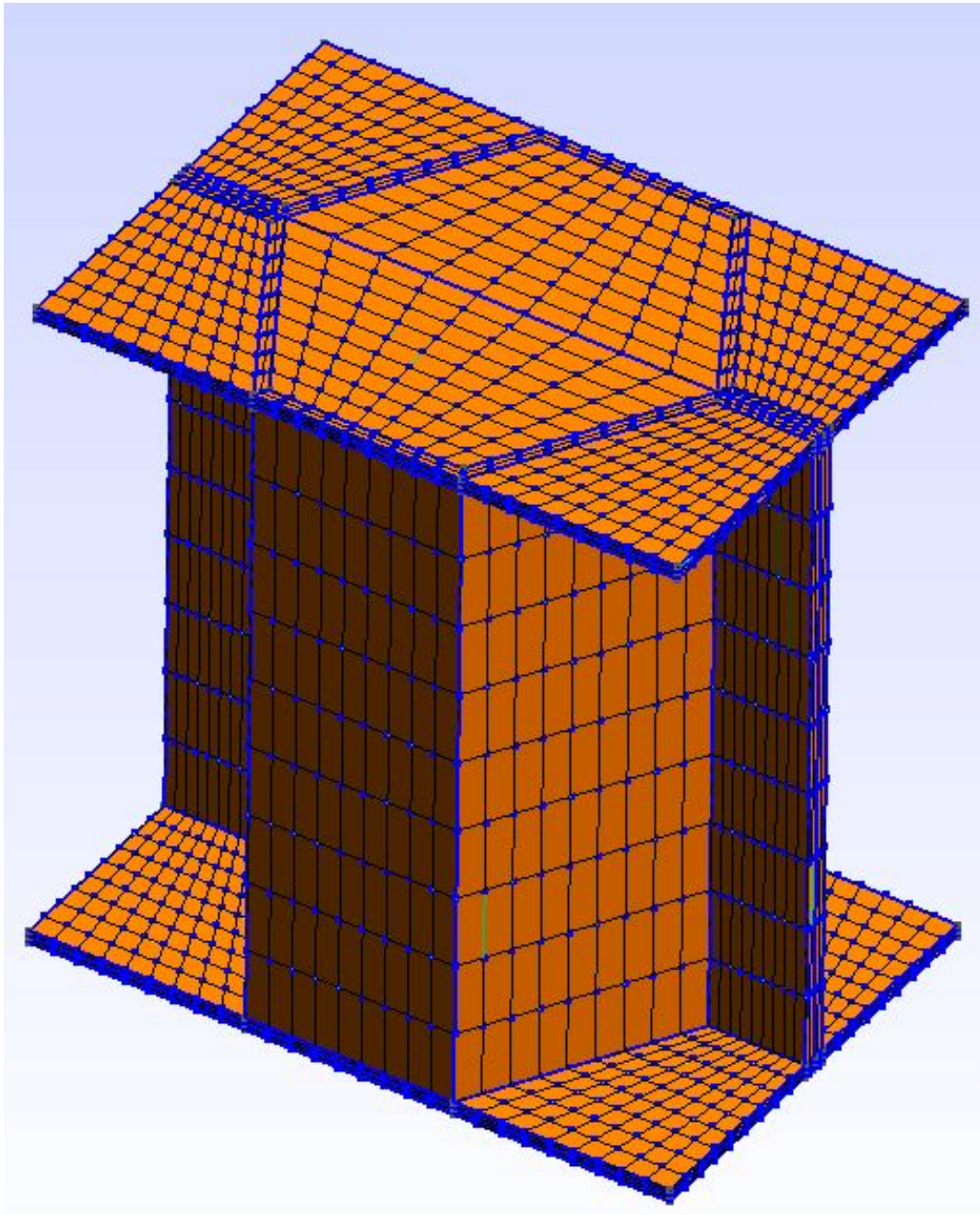
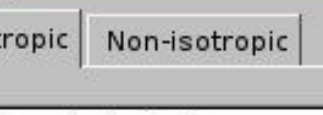


Fig. 4

* Click [SwiftComp](#)->Homogenization->Plate model. Keep the default parameters and click save and run. The homogenization results will automatically pop up (Fig. 5.).

2. step 2



Input failure constants

Isotropic Non-isotropic

1-Max principal stress Criteria

1 -- core Material

Add

Strength constants

Max principal stress

69 Tensile strength 250 Compressive strength

Add

Fig. 7

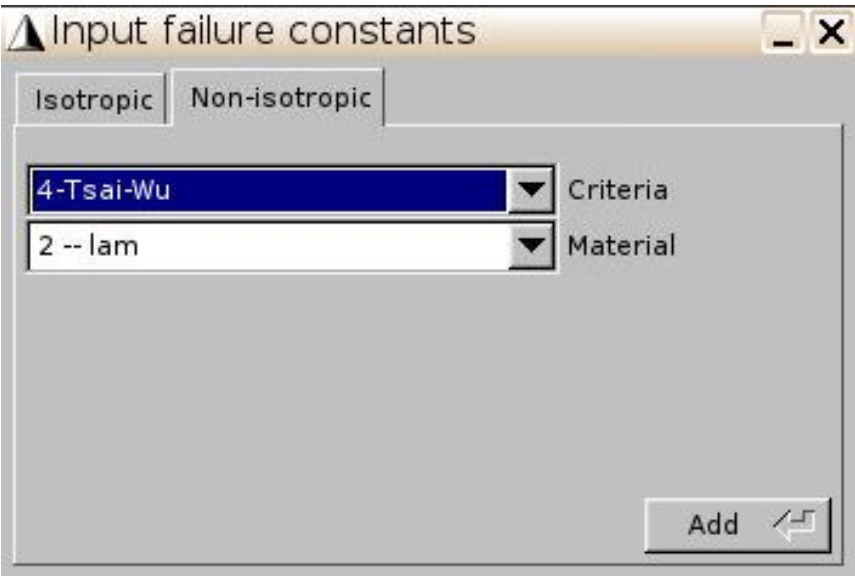


Fig. 8

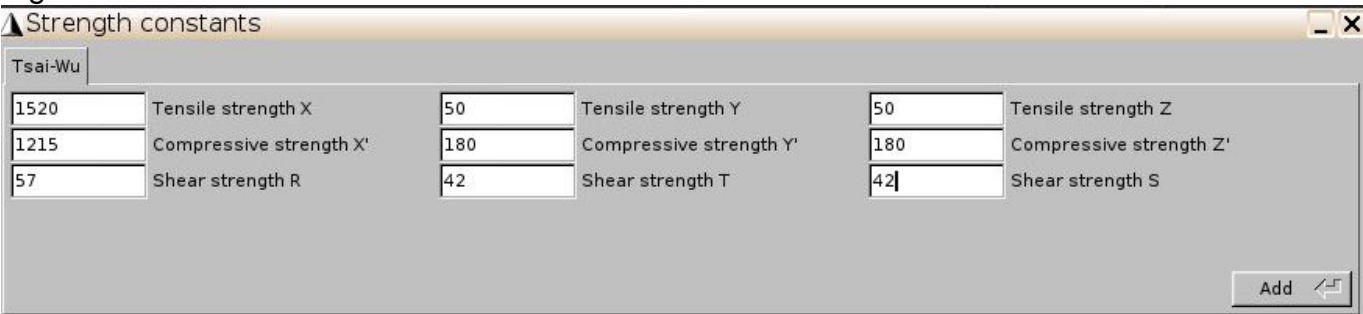


Fig. 9

* Click Failure index and strength ratio and select stress-based failure criterion. Click add. Select plate model and input and loads as shown in Fig. 10.

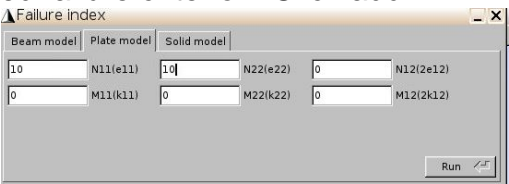


Fig. 10

* Click Run. The contour plots of the failure index and strength ratio under this loading condition is given as shown in Fig. 11 and 12.

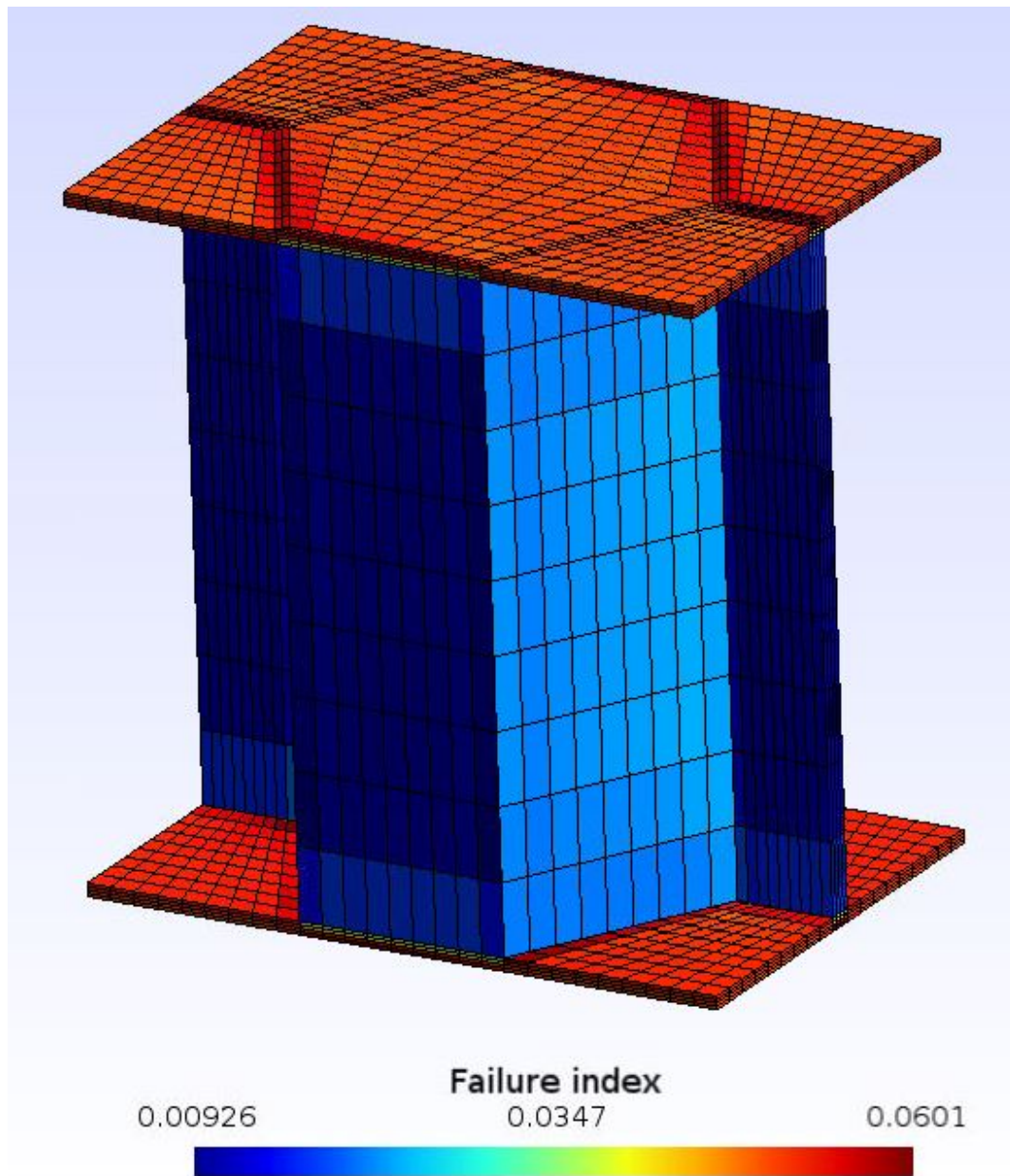


Fig. 11

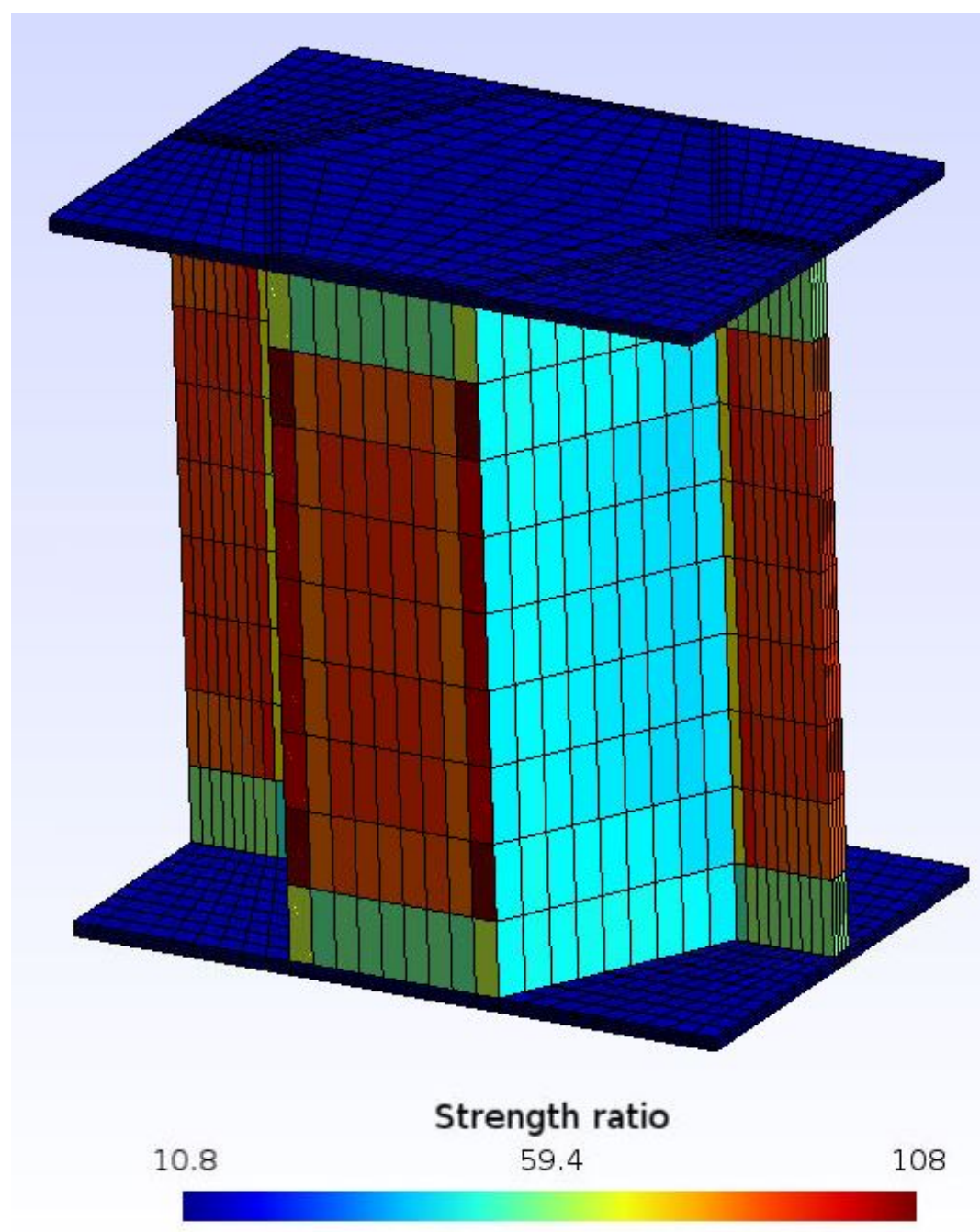


Fig. 12