Bending plate analysis in ABAQUS package

Tomasz Żebro, Jerzy Pamin

Version 1.1, 2017-05-18

1. Problem definition

The task is to solve the statics of a slab (plate in bending). The geometry of the plate, its thickness, boundary conditions and loading are defined in the figure below. Decide about the set of physical units you use – here data will be input in Newtons and meters.



2. Modelling in ABAQUS package

The tutorial is written assuming the user has made first steps in ABAQUS modelling and solved the problem of statics of a panel (plane stress two-dimensional case). Whenever a step of model generation procedure is similar to the case of a panel the Reader is referred to the introductory tutorial.

Abbreviation used: (SC) – single-click of left mouse button, (DC) – double-click of left mouse button. Remark: the input can be specified following the *Model Tree* on the left or alternatively selecting a sequence of

Modules and picking icons in the center.

| Basic data | Create Part | |
|---|--|------------------|
| Model Tree/(DC)Parts | Name: Part-1 | |
| Set: 3D space, Deformable | Modeling Space | |
| body. Base Feature: Shell. | 💿 3D 🔘 2D Planar 🔘 Axisymmetric | |
| Type: Planar Approximate | | |
| cize 20 (SC) Continue | Defensele | |
| size zo. (SC) continue | Discrete rigid | |
| | Analytical rigid None available | |
| | © Eulerian | |
| | | |
| | Base Feature | |
| | Shape Type | |
| | © Shall Extrusion | |
| | Wire | |
| | © Point Sweep | |
| | | |
| | Approximate size: 20 | |
| | Continue Cancel | |
| Slab geometry | Module (Part Model: Model: Model: Part Part) | 1 |
| In the sketcher pick the | | |
| segment line and generate | | |
| a rectangular domain | | |
| 6mx3m. | | |
| | | |
| | 000 + +, A, | |
| | <u>い</u> 人。 外展 | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | BSIMULIA |
| Material definition | Edit Material | BS |
| Material definition Model Tree /(DK)Materials | Edit Material | B SIMULIA |
| Material definition Model Tree /(DK)Materials Define isotropic elastic | Edit Material Name: Material-1 Description: Edit | 25 SIMULIA |
| Material definition Model Tree /(DK)Materials Define isotropic elastic material with E=30E9, | Edit Material Edit | 25 STRULIA |
| Material definition Model Tree /(DK)Materials Define isotropic elastic material with E=30E9, v=0.16. (SC) OK | Edit Material Kame: Material-1 Description: Edit Material Behaviors Floation | ZIMULA |
| Material definition Model Tree /(DK)Materials Define isotropic elastic material with E=30E9, v=0.16. (SC) OK | Edit Material Constrained Edit. Material Behaviors Haterial Behaviors Haterial Behaviors Haterial Behaviors Haterial Behaviors Hate | |
| Material definition Model Tree /(DK)Materials Define isotropic elastic material with E=30E9, v=0.16. (SC) OK | Edit Material | Binnan |
| Material definition Model Tree /(DK)Materials Define isotropic elastic material with E=30E9, v=0.16. (SC) OK | Edit Material | 25 Samua |
| Material definition Model Tree /(DK)Materials Define isotropic elastic material with E=30E9, v=0.16. (SC) OK | Edit Material | Bannacia |
| Material definition Model Tree /(DK)Materials Define isotropic elastic material with E=30E9, v=0.16. (SC) OK | Edit Material Name: Material-1 Description: Edit Material Behaviors Elastic General Mechanical Ihermal Qther Delete | Bannaca |
| Material definition Model Tree /(DK)Materials Define isotropic elastic material with E=30E9, v=0.16. (SC) OK | Edit Material | <u>Banaca</u> |
| Material definition Model Tree /(DK)Materials Define isotropic elastic material with E=30E9, v=0.16. (SC) OK | Edit Material Image: Edit Material-1 Description: Edit Material Behaviors Elastic General Mechanical Ihermal Other Delete Elastic Type: Isotropic Suboptions | Bunnan |
| Material definition <i>Model Tree /(DK)Materials</i> Define isotropic elastic material with E=30E9, v=0.16. (SC) <i>OK</i> | Edit Material Name: Material-1 Description: Edit Material Behaviors Elastic General Mechanical Ihermal Other Delete Elastic Type: Isotropic Use temperature-dependent data | Bannau |
| Material definition Model Tree /(DK)Materials Define isotropic elastic material with E=30E9, v=0.16. (SC) OK | Edit Material Name: Material-1 Description: Edit Material Behaviors Elastic Elastic Elastic Elastic Use temperature-dependent data Number of field variables: | Banau |
| Material definition Model Tree /(DK)Materials Define isotropic elastic material with E=30E9, v=0.16. (SC) OK | Edit Material Name: Material-1 Description: Edit Material Behaviors Elastic Elastic Elastic Type: Isotropic Use temperature-dependent data Number of field variables: O Moduli time scale (for viscoelasticity): Long-term | BIONNELA |
| Material definition Model Tree /(DK)Materials Define isotropic elastic material with E=30E9, v=0.16. (SC) OK | Edit Material Name: Material-1 Description: Edit Material Behaviors Elastic General Mechanical Ihermal Qther Delete Elastic Type: Isotropic Suboptions Use temperature-dependent data Number of field variables: O Moduli time scale (for viscoelasticity): Iong-term | BIONNELA |
| Material definition Model Tree /(DK)Materials Define isotropic elastic material with E=30E9, v=0.16. (SC) OK | Edit Material Name: Material-1 Description: Edit Material Behaviors Elastic Seneral Mechanical Ihermal Qther Elastic Type: Isotropic Use temperature-dependent data Number of field variables: Oil Moduli time scale (for viscoelasticity): Long-term No compression No tension | Benner |
| Material definition Model Tree /(DK)Materials Define isotropic elastic material with E=30E9, v=0.16. (SC) OK | Edit Material Name: Material-1 Description: Edit Material Behaviors Elastic Seneral Mechanical Ihermal Qther Elastic Type: Isotropic Use temperature-dependent data Number of field variables: O: Moduli time scale (for viscoelasticity): Long-term No compression No tension | Benner |
| Material definition Model Tree /(DK)Materials Define isotropic elastic material with E=30E9, v=0.16. (SC) OK | Edit Materia | Benner |
| Material definition Model Tree /(DK)Materials Define isotropic elastic material with E=30E9, v=0.16. (SC) OK | Edit Material Name: Material-1 Description: General Mechanical Inermal Qther Delete Elastic Type: Inermal Qther Delete Elastic Type: Inermal Qther Delete Inermal Qther Delete Inermal Qther Delete Inermal Qther Delete Value Inermal Qther Delete Value Value Inermal Qther Inermal Qther Delete Value Value Value Inermal | Bennera |
| Material definition Model Tree /(DK)Materials Define isotropic elastic material with E=30E9, v=0.16. (SC) OK | Edit Material Name: Material-1 Description: Edit. Material Behaviors Elastic Type: Isotropic Use temperature:-dependent data Number of field variables: Oil: Not tension Data Young's Young's Naterial 1 30E9 | Bunner |
| Material definition Model Tree /(DK)Materials Define isotropic elastic material with E=30E9, v=0.16. (SC) OK | Edit Material Name: Material-1 Description: Edit Material Behaviors Edit Estic Type: [sotropic Use temperature-dependent data Number of field variables: O: Moduli time scale (for viscoelasticity): Long-term No compression No tension Data 1 3059 | Banner |
| Material definition Model Tree /(DK)Materials Define isotropic elastic material with E=30E9, v=0.16. (SC) OK | Edit Material Name: Material-1 Description: Idaterial Behaviors Seneral Mechanical Thermal Other Elastic Type: [sotropic Vumber of field variables: Image: | Bannau |
| Material definition Model Tree /(DK)Materials Define isotropic elastic material with E=30E9, v=0.16. (SC) OK | Edit Material Name: Material-1 Description: Edit. Material Behaviors Elastic Type: Suboptions Use temperature-dependent data Number of field variables: O the temperature-dependent data Number of field variables: O compression Data Young's Poisson's 1 30E9 0.16 | Biomain |
| Material definition Model Tree /(DK)Materials Define isotropic elastic material with E=30E9, v=0.16. (SC) OK | Edit Material Name: Material Description: Edit. Identic Edit. Elestic Type: Type: Elotropic Use temperature-dependent data Number of field variables: 0 Moduli time scale (for viscoelasticity): Long-term No compression No tension Data 016 | Binner |

| Section definition | Edit Section |
|------------------------------------|--|
| Model Tree/(DK)Sections | Name: Section-1 |
| Define section (thickness) | Type: Shell / Continuum Shell, Homogeneous |
| by setting: Shell, | Section integration: (a) During analysis (b) Before analysis |
| Homogenous, | Basic Advanced |
| (SC) <i>Continue,</i> input | |
| thickness 0.20 as shown in | Shell thickness: Value: 0.20 |
| the ligure. (SC)OK | \bigcirc Element distribution: |
| | Nodal distribution: |
| | Material: Material-1 Create |
| | Thickness integration rule: Simpson Gauss |
| | Thickness integration points: 5 |
| | Options: Rebar Lavers |
| | OK |
| | Edit Section Assignment |
| Next associate the | Region |
| model part via section | Region: (Picked) |
| assignment: | Section |
| Model Tree/Parts/Part- | Section: Section-1 |
| 1/Section Assignments | Note: List contains only sections applicable to the selected regions. |
| (SC) <i>OK</i> | Type: Shell, Homogeneous |
| | Material: Material-1 |
| | ⊂ Thickness |
| | Assignment: From section From geometry |
| | Shell Offset |
| | Definition: Middle surface V Create |
| | |
| | OK Cancel |
| Instance generation | Create Instance |
| Model Tree/(DK)Assembly | Parts |
| Instances | Part-1 |
| Accept the default options | |
| instance for the analyzed | |
| nart | |
| | Instance Type |
| | Dependent (mesh on part) |
| | Independent (mesh on instance) |
| | Note: To change a Dependent instance's mesh, you must edit its part's mesh. |
| | Auto-offset from other instances |
| | OK Apply Cancel |
| Looded autors | |
| Loaded Surface | |
| (DK)Surfaces | Create Surface |
| Select the plate surface to | Name: Surf-1 |
| be loaded: | Type: Geometry |
| (SC) <i>Continue,</i> click in the | Continue Cancel |
| rectangular domain and | |
| confirm (SC) Done, pick | |
| the purple surface. | Choose a side for the shell or internal faces: Brown Purple Both sides |







