

CDS Training Exercise Manual

Release edition 3 October 2026

This manual collects the CDS learning pages, 140 exercises, examples and case studies. All existing studies and exercise numbers remain available in the main curriculum. Each exercise identifies its task, connected models, data transfers, checkpoints and limitations. Work through the setup before changing inputs, and use the stated reference or validation scope to decide what the result demonstrates. Numerical teaching data should not be substituted for qualified design allowables.

Preface

This manual is intended for guided study, classroom use and independent practice. Each exercise retains its original identifier so that the printed walkthrough can be matched to the Workbench record. The chapters follow the curriculum stages. Within an exercise, read the purpose, inspect the connected inputs, establish the supplied baseline and only then carry out the proposed comparisons.

A useful exercise record includes more than its final image. Record the changed inputs, the units, the model selections and the checkpoint observations. Explain why the response changed and which assumptions limit that explanation. Some studies are illustrative and some compare a specified analytical or published reference; those are different levels of evidence and must remain distinguished in the conclusion.

How to use this manual

Read the assumptions before choosing a model. Keep units consistent, inspect solver notices and use the recorded checks to distinguish a completed calculation from a validated result. Chapter links lead to the interactive website; exercise links open the Workbench. Account-controlled database downloads and classroom materials remain subject to their existing access rules.

Equations are editable Word mathematics. This PDF is exported from the same Word document. Historical reference chapters retain their stated scope; the current workflow and exercise chapters describe the available CDS implementation.

Contents

01.01 Rule of mixtures fibre volume fraction	6
01.02 Compare transverse micromechanics models.....	9
01.03 Short fibers aspect ratio and shear-lag transfer	11
01.04 Rule of mixtures continuous fibers	14
01.05 Halpin Tsai transverse stiffness.....	17
01.06 Short fibers shear-lag transfer	19
01.07 Hybrid fibers orientation distribution	22
01.08 NASA T700/PR520 lamina analysis	25
01.09 T700S / 180C Epoxy UD stored-ply elasticity	27
01.10 IM7 / Toughened Epoxy UD stored-ply elasticity.....	30
01.11 T800S / BMI UD stored-ply elasticity	33
01.12 AS4 / PEEK UD stored-ply elasticity.....	36
01.13 T300 / EPON 862 Epoxy UD Prepreg stored-ply elasticity.....	39
01.14 T800S / 977-3-Type Epoxy UD Prepreg stored-ply elasticity	42
01.15 AS4 / LY 1564-Type Epoxy UD Prepreg stored-ply elasticity.....	45
01.16 T300 / Phenolic Plain Weave stored-ply elasticity	48
01.17 UD carbon / epoxy Vf 45	51
01.18 UD carbon / epoxy Vf 65	53
01.19 Balanced plain weave screening.....	55
01.20 Warp-rich twill screening.....	57
01.21 Triaxial braid $\pm 30^\circ$ screening	59
01.22 Triaxial braid $\pm 60^\circ$ screening	61
01.23 Short carbon / epoxy L/d 25.....	63
01.24 Short carbon / epoxy L/d 100.....	65
01.25 Glass particles / epoxy Vf 10	67
01.26 Glass particles / epoxy Vf 25	69
01.27 3D-print feedstock chopped carbon / PA6 teaching	71
01.28 3D-print feedstock chopped glass / PET teaching.....	73
01.29 Short fibers alignment and stiffness.....	75
01.30 Micro porosity sensitivity at fixed reinforcement	78
01.31 Micro warp fraction and weave efficiency.....	80
02.01 FSDT plate bending thin-to-thick comparison	82
02.02 Micro optimization stiffness voids and density	84
02.03 FSDT cross-ply plate buckling and natural frequencies	86
02.04 Laminate optimization minimum mass under axial loading	89
02.05 FSDT soft-core plate shear-dominated bending.....	92
02.06 Process optimization cycle time and thermal uniformity.....	94
02.07 Sandwich FSDT clamped panel bending.....	97
02.08 Laminate orientation and tensile response	100
02.09 $\pm 45^\circ$ coupon in-plane shear.....	102
02.10 Three-point bending span and stiffness	104
02.11 Thin-wall pressure vessel.....	106
02.12 Tensile coupon laminate orientation	108
02.13 Sandwich FSDT biaxial compression buckling.....	110

02.14 $\pm 45^\circ$ laminate in-plane shear.....	113
02.15 Sandwich FSDT directional-core natural frequencies	115
02.16 Stored lamina material bypass Micro	118
02.17 Mixed stored/solved plies unequal thickness	121
02.18 Three-point bend deflection.....	124
02.19 Cylinder internal pressure	126
02.20 Lap joint two adherends and adhesive	128
02.21 Sandwich bend skins core and bond screening	130
02.22 Hybrid short fibers orientation and volume balance	132
02.23 T700/Epoxy Quasi-Isotropic stored-data layup.....	135
02.24 IM7/Toughened Epoxy Bending-Optimized stored-data layup.....	138
02.25 T800/BMI Balanced Cylinder stored-data layup	141
02.26 AS4/PEEK Quasi-Isotropic stored-data layup	144
02.27 T800/BMI Hoop-Dominant Cylinder stored-data layup	147
02.28 T700/Epoxy Cross-Ply stored-data layup	150
02.29 T700/Epoxy Balanced Angle-Ply stored-data layup	153
02.30 IM7/Toughened Epoxy Unidirectional stored-data layup.....	156
02.31 AS4/PEEK Cross-Ply stored-data layup.....	159
02.32 T300/Phenolic Woven Symmetric stored-data layup	162
02.33 T300/EPON 862 Quasi-Isotropic stored-data layup	165
02.34 T800/977-3 Quasi-Isotropic stored-data layup	168
02.35 AS4/LY 1564 Quasi-Isotropic stored-data layup	171
02.36 IM7/8552-Type Quasi-Isotropic stored-data layup	174
02.37 Quasi-Isotropic Plate in Uniaxial Tension resultant response.....	177
02.38 Cross-Ply Plate under Pure Bending resultant response	180
02.39 Angle-Ply Plate under Biaxial Load and Shear resultant response	183
02.40 NASA Balanced T700/epoxy tube laminate.....	186
02.41 High-ply optimization 48-ply axial mass study.....	189
02.42 High-ply optimization 64-ply combined-load strength study	192
02.43 Short fibers alignment carried into laminate stiffness	195
03.01 Thermal cycle surface-to-core lag	198
03.02 Pultrusion heating and cooling dies	200
03.03 Pultrusion multi-zone die and pulling speed	203
03.04 UV cure exposure penetration and exotherm.....	206
03.05 Moisture conditioning and diffusion	209
03.06 Bonded joint two adherends and adhesive.....	211
03.07 NASA AS4/3501-6 pressure-cylinder screening.....	213
03.08 NASA Thick T700S/TC380 cure process.....	216
03.09 Coupled cure thermal moisture and structural response.....	219
03.10 Thermal cycle surface/core lag.....	222
03.11 Moisture conditioning diffusion	224
03.12 Pultrusion multi-zone die	226
03.13 UV cure penetration and exotherm.....	229
03.14 Moisture expansion + structural load.....	232
03.15 Mixed Micro recipes cure + structural response	235
03.16 Cure + thermal + moisture + structural	238

03.17 Coupled ply damage + delamination growth	241
03.18 D6641 Compression coupon	243
03.19 D5379 / D7078 Shear coupon	246
03.20 D5528 DCB opening	249
03.21 D7905 ENF sliding.....	252
03.22 D6671 Mixed-mode fracture envelope	255
03.23 D5229 Moisture uptake calibration.....	258
03.24 D5961 Bearing / bypass screening.....	261
03.25 D6484 Open-hole compression	264
03.26 D6742 Filled-hole comparison.....	267
03.27 D7136 / D7137 Impact CAI assessment.....	270
03.28 Wiener series and parallel.....	273
03.29 Looyenga / Landau Lifshitz Looyenga.....	276
03.30 Maxwell Garnett	279
03.31 Normal-incidence laminate TMM	282
03.32 Bruggeman symmetric EMT	285
03.33 EM Mori Tanaka	288
03.34 EM self-consistent	291
03.35 Differential effective medium	294
03.36 Coated sphere and interphase.....	297
03.37 Generalized multiphase EMT.....	300
03.38 Oblique polarized laminate TMM.....	303
03.39 1D transmission line matrix	306
03.40 1D Floquet Bloch periodic layers.....	309
03.41 Open-hole strength	312
03.42 Creep stress relaxation	315
03.43 Analytical bonded joint.....	318
03.44 LaRC04 failure initiation	321
03.45 Tool-release shape	324
03.46 Fatigue residual properties.....	327
03.47 Cylinder buckling.....	330
03.48 Uncertainty sensitivity	333
03.49 Hot/wet plate biaxial loading and environmental strain.....	336
03.50 Thermal warping unsymmetric versus symmetric cross-ply	339
03.51 Moisture warping conditioning an unsymmetric cross-ply.....	342
03.52 Pultrusion pulling speed outlet cure and loaded stiffness.....	345
03.53 UV cure post-gel shrinkage and residual ply stresses.....	348
03.54 UV cure equal-energy one-sided versus two-sided exposure.....	351
03.55 UV cure does equal dose produce equal residual stress.....	354
03.56 UV cure thickness core conversion and locked-in stress	357
03.57 Pultrusion throughput faster pulling versus structural response	360
03.58 Pultrusion thick-section cure lag and loaded stiffness.....	363
03.59 Hot/wet angle-ply shear loading and environmental coupling	366
03.60 Thermal bend twist reverse an unsymmetric angle-ply.....	369
03.61 Moisture plus applied bending competing curvature contributions.....	372
03.62 Thick laminate reaction heating cure gradient and process stress.....	375

03.63 Oven cycle gentle ramp and core-temperature lag	378
03.64 Oven cycle two-stage dwell and exotherm.....	381
03.65 Oven cycle unequal surface convection	384
Balsa sandwich seawater on one face	387
Glossary and notation	390
References and further reading	391

01.01 Rule of mixtures fibre volume fraction

Online chapter

The starting point for a laminate calculation is the behaviour of its individual plies. Here you will follow the connection from fibre and resin properties to the effective properties of a unidirectional ply, using controlled comparisons to see which predictions depend on composition and which depend on the micromechanics formulation.

[Open this exercise in Workbench](#)



Figure 1. Used model inputs for 01.01 · Rule of mixtures: fibre volume fraction

Used records in the standard workflow layout. Hidden records remain in Workbench. This diagram is not a calculated result.

Prepare the baseline

Establish the supplied case before changing anything. Keep a small comparison table with the constituent properties, fibre fraction, selected model and resulting moduli. When the task changes the model, leave the material data unchanged; when it changes the fraction, keep the model fixed. This makes it possible to explain the source of a difference instead of merely observing that two numbers disagree.

Worked procedure

1. Begin by opening the copied Micro record and following its links to the fibre and matrix materials. Note the constituent moduli and density, including their units, because these are the values that the mixture calculation will use. Keeping this input record beside your results will make the later hand calculation traceable.
2. Run three cases with fibre volume fractions of 0.3, 0.5 and 0.7, leaving the constituent data and other settings unchanged. After each change, use Run and record E1, E2 and density from the Micro outputs before moving to the next fraction. Arrange the three results in one table so that you can compare longitudinal and transverse response without relying on memory or mismatched screenshots.
3. Use the linked constituent moduli to calculate $E1 = V_f E_f + (1 - V_f) E_m$ for each of the three fibre fractions. Compare those hand calculations with the corresponding CDS values, first checking that both use the same units. Explain any discrepancy in terms of the selected inputs and model; this particular comparison concerns the longitudinal mixture relation, not every property in the output table.

Review checkpoints

At zero void fraction, constituent fractions sum to one.

Longitudinal modulus follows the linear mixture calculation; distinguish it from the transverse compliance estimate.

Model limits

Ideal continuous, aligned reinforcement with zero voids. This is a teaching comparison, not a measured material allowable.

Interpret the comparison

Read longitudinal, transverse and shear results as different responses, rather than expecting one mixture estimate to describe them all. Where the exercise provides published comparison values, calculate the discrepancy using those values and the specified units. Agreement in stiffness does not establish measured strength or validate properties that the chosen model does not predict.

How information passes between models

Materials → Micro: Constituent stiffness, strength, density and thermal / moisture properties.

Models → Micro: Applied model assignment: Rule of mixtures. Model parameters and formulation are used by Micro.

Further reading and evidence

- [Create and connect a lamina](#)
- [Edit material properties and units](#)
- [Run and review a model](#)
- [Review effective properties](#)
- [Related case study: NASA lamina analysis](#)

[Review the recorded validation scope](#) . Retain the original inputs and solver notices with the results. Representative teaching data are not design allowables.

01.02 Compare transverse micromechanics models

Online chapter

The starting point for a laminate calculation is the behaviour of its individual plies. Here you will follow the connection from fibre and resin properties to the effective properties of a unidirectional ply, using controlled comparisons to see which predictions depend on composition and which depend on the micromechanics formulation.

[Open this exercise in Workbench](#)

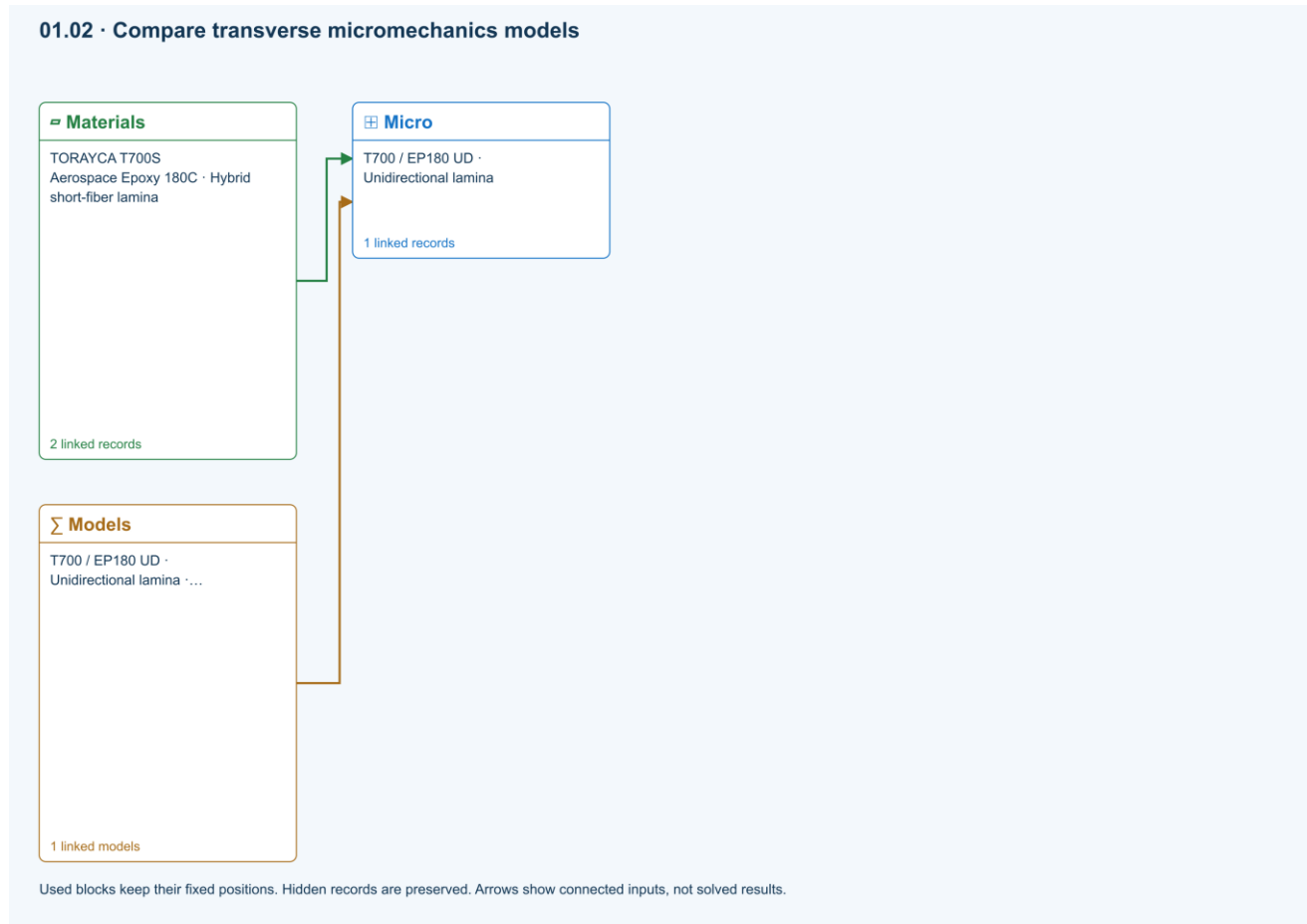


Figure 2. Used model inputs for 01.02 · Compare transverse micromechanics models

Used records in the standard workflow layout. Hidden records remain in Workbench. This diagram is not a calculated result.

Prepare the baseline

Establish the supplied case before changing anything. Keep a small comparison table with the constituent properties, fibre fraction, selected model and resulting moduli. When the task changes the model, leave the material data unchanged; when it changes the fraction, keep the model fixed. This makes it possible to explain the source of a difference instead of merely observing that two numbers disagree.

Worked procedure

1. Run the supplied Halpin–Tsai Micro recipe without changing its initial settings, and retain E1, E2 and G12 as the baseline. Record the reinforcement fraction and constituent data with these outputs. The next comparison is meaningful only if both formulations receive the same material system.
2. Change the micromechanics model to Rule of mixtures while leaving the constituent properties and fractions unchanged, then rerun the case. Compare E1, E2 and G12 with the Halpin–Tsai baseline. Discuss which properties are most sensitive to the change in formulation rather than reducing the comparison to one overall statement that a model is stiffer.
3. Restore Halpin–Tsai before varying fibre volume fraction, so that this second comparison examines composition rather than switching formulations at the same time. Keep the constituent data fixed and record the fraction used for each run. Explain the resulting trends in the context of the selected model and its assumptions.

Review checkpoints

Compare transverse and shear predictions at identical fractions.

Explain why different homogenization assumptions give different transverse properties.

Model limits

Use the editable model inputs and their documented assumptions; matching a trend does not validate a strength prediction.

Interpret the comparison

Read longitudinal, transverse and shear results as different responses, rather than expecting one mixture estimate to describe them all. Where the exercise provides published comparison values, calculate the discrepancy using those values and the specified units. Agreement in stiffness does not establish measured strength or validate properties that the chosen model does not predict.

How information passes between models

Materials → Micro: Constituent stiffness, strength, density and thermal / moisture properties.

Models → Micro: Applied model assignment: Halpin–Tsai. Model parameters and formulation are used by Micro.

Further reading and evidence

- [Create and connect a lamina](#)
- [Review effective properties](#)
- [Run and review a model](#)
- [Related case study: NASA lamina analysis](#)

[Review the recorded validation scope](#) . Retain the original inputs and solver notices with the results. Representative teaching data are not design allowables.

01.03 Short fibers aspect ratio and shear-lag transfer

Online chapter

This exercise examines how reinforcement geometry and orientation affect the effective elastic response of a short-fibre material. The aim is to connect the model inputs to the resulting directional properties, while keeping elastic load transfer separate from a prediction of fibre breakage or composite strength.

[Open this exercise in Workbench](#)

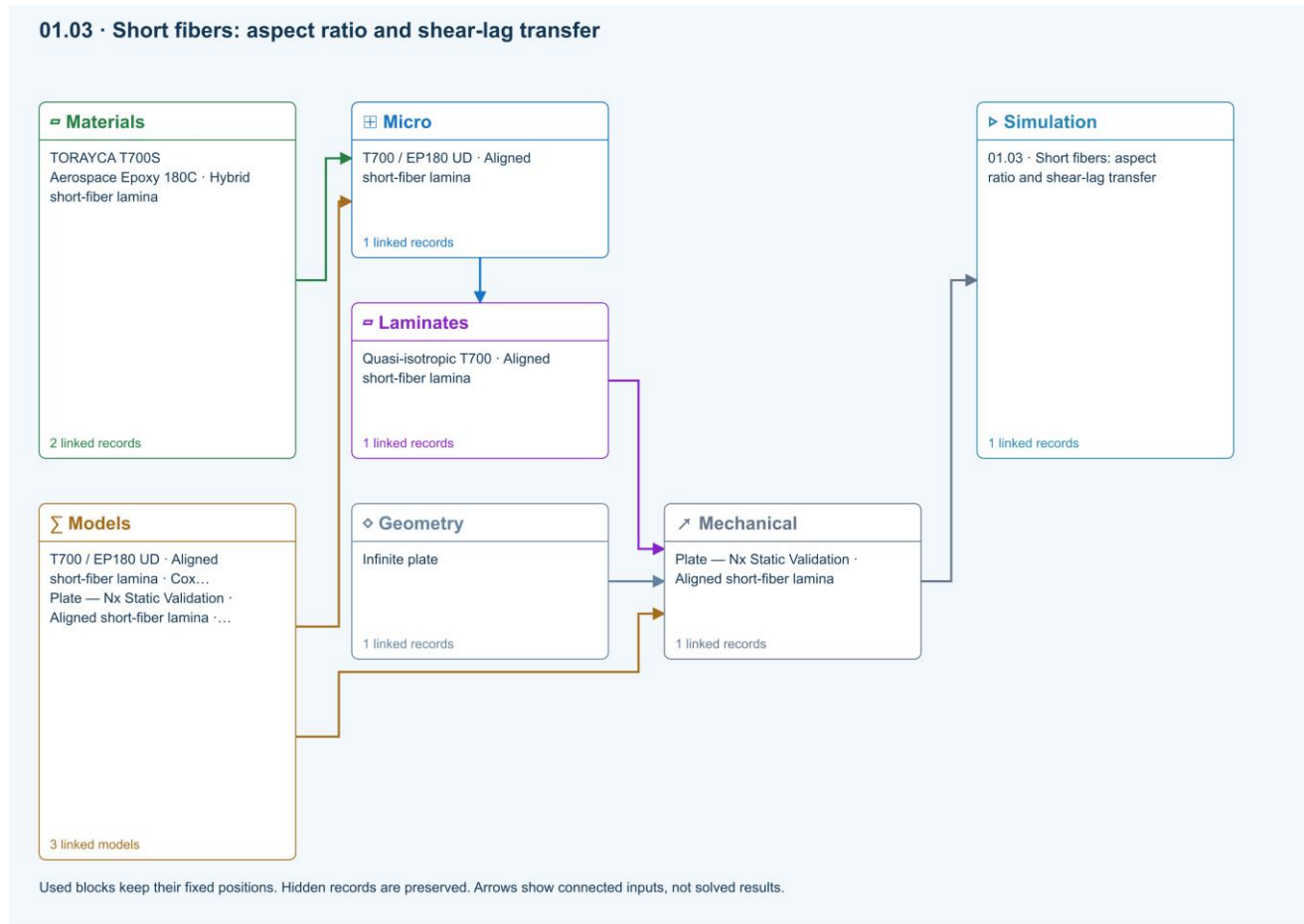


Figure 3. Used model inputs for 01.03 · Short fibers: aspect ratio and shear-lag transfer

Used records in the standard workflow layout. Hidden records remain in Workbench. This diagram is not a calculated result.

Prepare the baseline

Before running, note fibre length, diameter, fractions and orientation settings. Change the quantity requested in the task while retaining the other settings, then record all directional moduli rather than only the largest one. Where two geometries have the same aspect ratio, compare their results explicitly; this helps identify which geometric information the selected idealization actually uses.

Worked procedure

1. Open Micro: identify length 0.35 mm, diameter 7 μm and derived $L/d = 50$. Inspect the linked constituent moduli.
2. Run at lengths 0.07, 0.35 and 3.5 mm, keeping diameter fixed. Compare E1, shear-lag efficiency and elastic transfer length in Micro outputs.
3. Double both length and diameter. Rerun and explain why aspect ratio and elastic stiffness are unchanged.
4. Open Response → Failure. Compare the available classical criteria using the independent teaching allowables in Micro → Strength & failure; do not interpret them as measured T700 short-fiber strengths.

Review checkpoints

Efficiency increases toward one as aspect ratio increases; E1 approaches the aligned continuous-fiber mixture limit.

RVE progressive failure remains disabled. Cox predicts elastic transfer, not critical break length or damage evolution.

Strength values in this exercise are illustrative assumptions, not predictions or qualified allowables.

Model limits

Aligned monodisperse elastic fibers, perfect interface and concentric-cell shear lag. Halpin–Tsai transverse/shear screening closure. Existing constituent data are reused; the short-fiber composite and its strength allowables are a hypothetical teaching system.

Interpret the comparison

Use the model's reported transfer and efficiency outputs to explain the stiffness comparison. Treat any displayed fibre geometry as an illustration unless its dimensions are explicitly part of the calculation. If you save the result as a material, inspect which fields were predicted and which remain blank; an elastic snapshot is not a complete set of qualified material properties.

How information passes between models

Micro → Laminates: Predicted ply stiffness, strength, density and expansion properties.

Materials → Micro: Constituent stiffness, strength, density and thermal / moisture properties.

Mechanical → Simulation: SIMULATION selects this case and its analysis model; the case owns its applicable cycle and input references.

Laminates → Mechanical: Ply angles and thicknesses, stiffness, mass and ply properties.

Geometry → Mechanical: Part shape and dimensions, thickness or section definition, and model-specific geometric inputs. Each selected case consumes only the dimensions its model supports.

Models → Micro: Applied model assignment: Cox shear-lag elastic. Model parameters and formulation are used by Micro.

Models → Mechanical: Applied model assignment: CLT · Linear static with failure indices. Model parameters and formulation are used by Mechanical.; Maximum stress

Further reading and evidence

- [Create and connect a lamina](#)
- [Edit material properties and units](#)
- [Run and review a model](#)
- [Review effective properties](#)
- [Connected inputs and result freshness](#)
- [Edit laminate materials, angles and thicknesses](#)
- [Related case study: NASA lamina analysis](#)

[Review the recorded validation scope](#) . Retain the original inputs and solver notices with the results. Representative teaching data are not design allowables.

01.04 Rule of mixtures continuous fibers

Online chapter

The starting point for a laminate calculation is the behaviour of its individual plies. Here you will follow the connection from fibre and resin properties to the effective properties of a unidirectional ply, using controlled comparisons to see which predictions depend on composition and which depend on the micromechanics formulation.

[Open this exercise in Workbench](#)

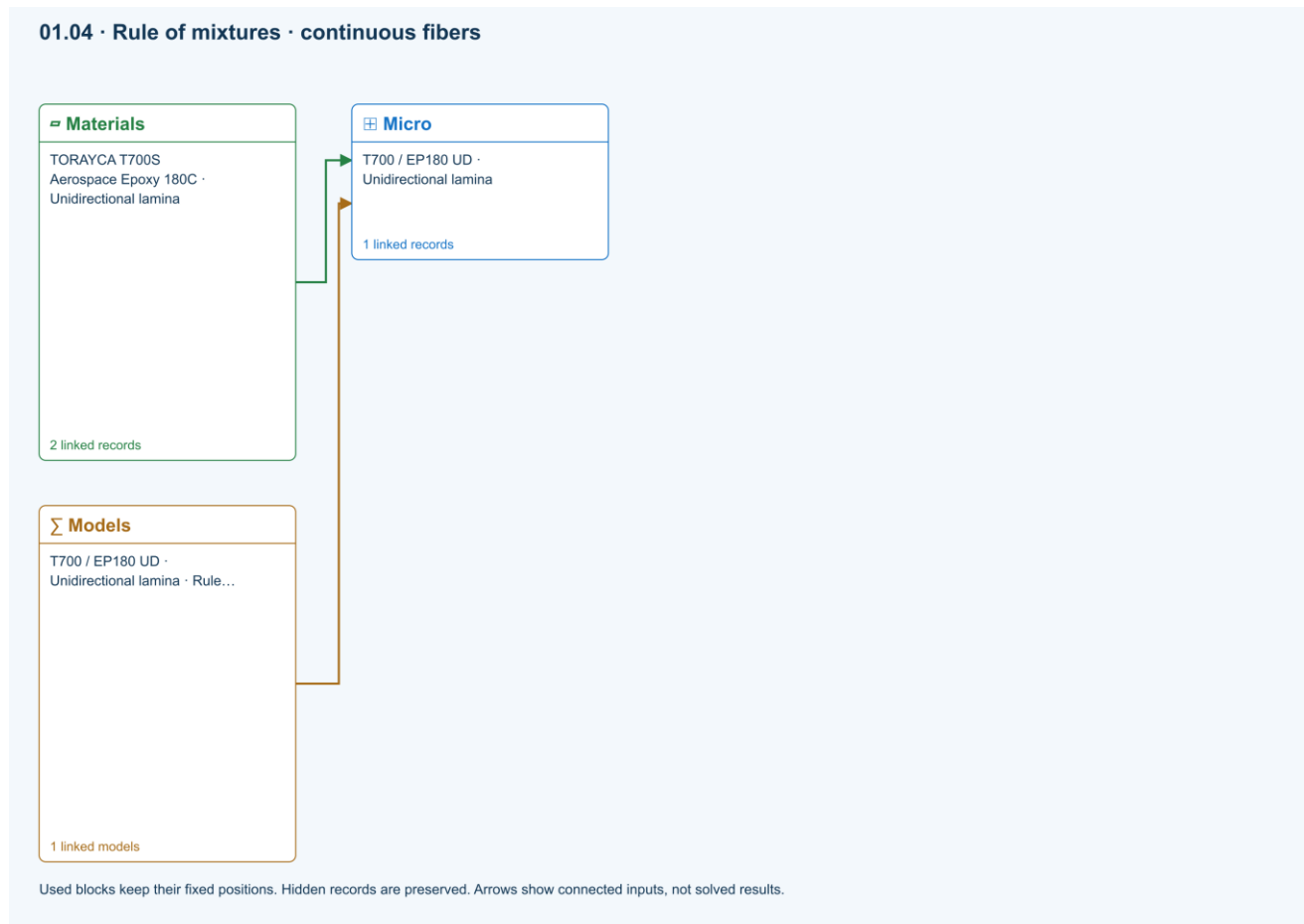


Figure 4. Used model inputs for 01.04 · Rule of mixtures · continuous fibers

Used records in the standard workflow layout. Hidden records remain in Workbench. This diagram is not a calculated result.

Prepare the baseline

Establish the supplied case before changing anything. Keep a small comparison table with the constituent properties, fibre fraction, selected model and resulting moduli. When the task changes the model, leave the material data unchanged; when it changes the fraction, keep the model fixed. This makes it possible to explain the source of a difference instead of merely observing that two numbers disagree.

Worked procedure

1. Begin by opening the copied Micro record and following its links to the fibre and matrix materials. Note the constituent moduli and density, including their units, because these are the values that the mixture calculation will use. Keeping this input record beside your results will make the later hand calculation traceable.
2. Run three cases with fibre volume fractions of 0.3, 0.5 and 0.7, leaving the constituent data and other settings unchanged. After each change, use Run and record E1, E2 and density from the Micro outputs before moving to the next fraction. Arrange the three results in one table so that you can compare longitudinal and transverse response without relying on memory or mismatched screenshots.
3. Use the linked constituent moduli to calculate $E1 = V_f E_f + (1 - V_f) E_m$ for each of the three fibre fractions. Compare those hand calculations with the corresponding CDS values, first checking that both use the same units. Explain any discrepancy in terms of the selected inputs and model; this particular comparison concerns the longitudinal mixture relation, not every property in the output table.

Review checkpoints

At zero void fraction, constituent fractions sum to one.

Longitudinal modulus follows the linear mixture calculation; distinguish it from the transverse compliance estimate.

Model limits

Ideal continuous, aligned reinforcement with zero voids. This is a teaching comparison, not a measured material allowable.

Interpret the comparison

Read longitudinal, transverse and shear results as different responses, rather than expecting one mixture estimate to describe them all. Where the exercise provides published comparison values, calculate the discrepancy using those values and the specified units. Agreement in stiffness does not establish measured strength or validate properties that the chosen model does not predict.

How information passes between models

Materials → Micro: Constituent stiffness, strength, density and thermal / moisture properties.

Models → Micro: Applied model assignment: Rule of mixtures. Model parameters and formulation are used by Micro.

Further reading and evidence

- [Create and connect a lamina](#)
- [Edit material properties and units](#)
- [Run and review a model](#)
- [Review effective properties](#)
- [Related case study: NASA lamina analysis](#)

[Review the recorded validation scope](#) . Retain the original inputs and solver notices with the results. Representative teaching data are not design allowables.

01.05 Halpin Tsai transverse stiffness

Online chapter

The starting point for a laminate calculation is the behaviour of its individual plies. Here you will follow the connection from fibre and resin properties to the effective properties of a unidirectional ply, using controlled comparisons to see which predictions depend on composition and which depend on the micromechanics formulation.

[Open this exercise in Workbench](#)



Figure 5. Used model inputs for 01.05 Halpin-Tsai transverse stiffness

Used records in the standard workflow layout. Hidden records remain in Workbench. This diagram is not a calculated result.

Prepare the baseline

Establish the supplied case before changing anything. Keep a small comparison table with the constituent properties, fibre fraction, selected model and resulting moduli. When the task changes the model, leave the material data unchanged; when it changes the fraction, keep the model fixed. This makes it possible to explain the source of a difference instead of merely observing that two numbers disagree.

Worked procedure

1. Run the supplied Halpin–Tsai Micro recipe without changing its initial settings, and retain E1, E2 and G12 as the baseline. Record the reinforcement fraction and constituent data with these outputs. The next comparison is meaningful only if both formulations receive the same material system.
2. Change the micromechanics model to Rule of mixtures while leaving the constituent properties and fractions unchanged, then rerun the case. Compare E1, E2 and G12 with the Halpin–Tsai baseline. Discuss which properties are most sensitive to the change in formulation rather than reducing the comparison to one overall statement that a model is stiffer.
3. Restore Halpin–Tsai before varying fibre volume fraction, so that this second comparison examines composition rather than switching formulations at the same time. Keep the constituent data fixed and record the fraction used for each run. Explain the resulting trends in the context of the selected model and its assumptions.

Review checkpoints

Compare transverse and shear predictions at identical fractions.

Explain why different homogenization assumptions give different transverse properties.

Model limits

Use the editable model inputs and their documented assumptions; matching a trend does not validate a strength prediction.

Interpret the comparison

Read longitudinal, transverse and shear results as different responses, rather than expecting one mixture estimate to describe them all. Where the exercise provides published comparison values, calculate the discrepancy using those values and the specified units. Agreement in stiffness does not establish measured strength or validate properties that the chosen model does not predict.

How information passes between models

Materials → Micro: Constituent stiffness, strength, density and thermal / moisture properties.

Models → Micro: Applied model assignment: Halpin–Tsai. Model parameters and formulation are used by Micro.

Further reading and evidence

- [Create and connect a lamina](#)
- [Review effective properties](#)
- [Run and review a model](#)
- [Related case study: NASA lamina analysis](#)

[Review the recorded validation scope](#) . Retain the original inputs and solver notices with the results. Representative teaching data are not design allowables.

01.06 Short fibers shear-lag transfer

Online chapter

This exercise examines how reinforcement geometry and orientation affect the effective elastic response of a short-fibre material. The aim is to connect the model inputs to the resulting directional properties, while keeping elastic load transfer separate from a prediction of fibre breakage or composite strength.

[Open this exercise in Workbench](#)

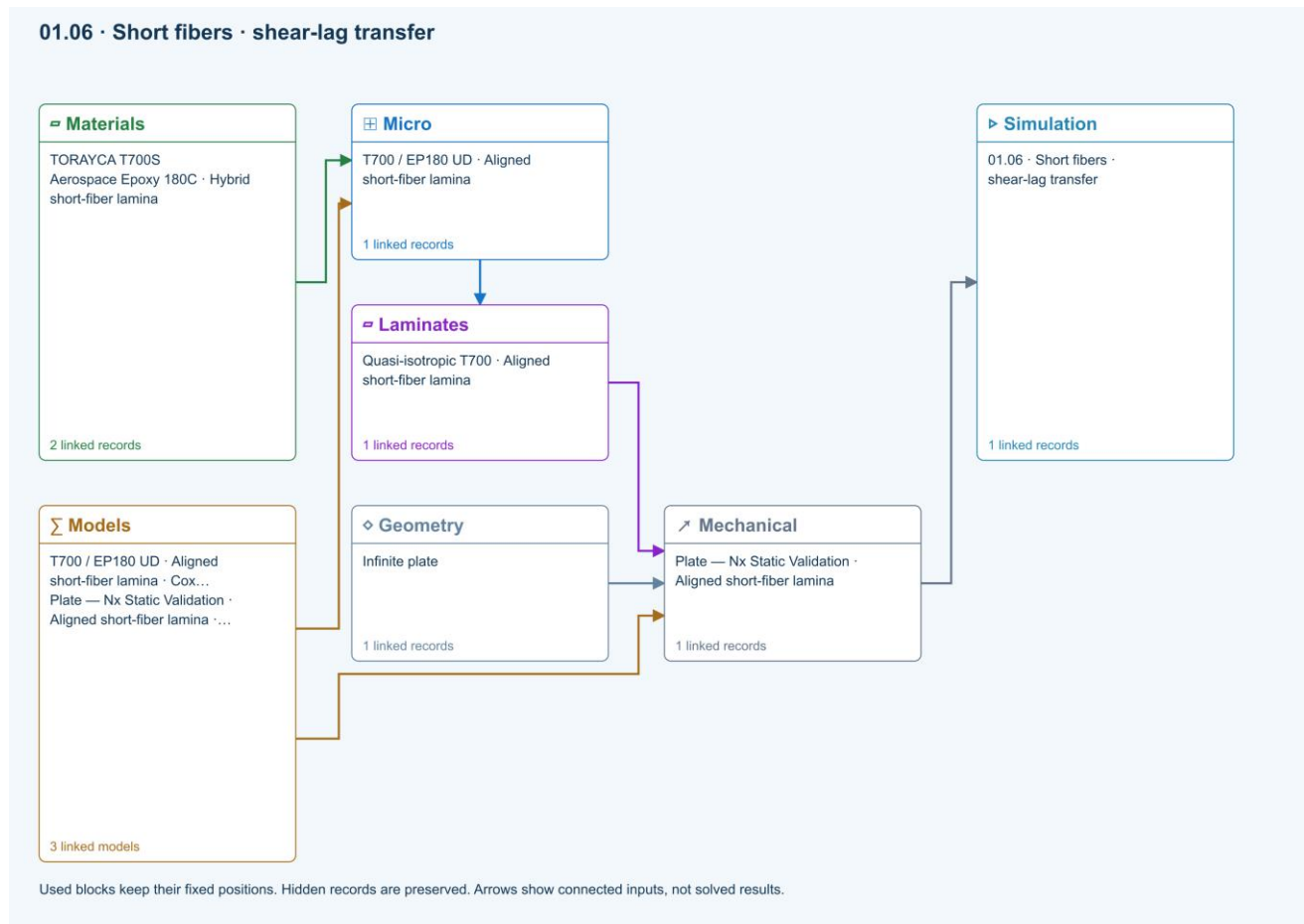


Figure 6. Used model inputs for 01.06 · Short fibers · shear-lag transfer

Used records in the standard workflow layout. Hidden records remain in Workbench. This diagram is not a calculated result.

Prepare the baseline

Before running, note fibre length, diameter, fractions and orientation settings. Change the quantity requested in the task while retaining the other settings, then record all directional moduli rather than only the largest one. Where two geometries have the same aspect ratio, compare their results explicitly; this helps identify which geometric information the selected idealization actually uses.

Worked procedure

1. Open Micro: identify length 0.35 mm, diameter 7 μm and derived $L/d = 50$. Inspect the linked constituent moduli.
2. Run at lengths 0.07, 0.35 and 3.5 mm, keeping diameter fixed. Compare E1, shear-lag efficiency and elastic transfer length in Micro outputs.
3. Double both length and diameter. Rerun and explain why aspect ratio and elastic stiffness are unchanged.
4. Open Response → Failure. Compare the available classical criteria using the independent teaching allowables in Micro → Strength & failure; do not interpret them as measured T700 short-fiber strengths.

Review checkpoints

Efficiency increases toward one as aspect ratio increases; E1 approaches the aligned continuous-fiber mixture limit.

RVE progressive failure remains disabled. Cox predicts elastic transfer, not critical break length or damage evolution.

Strength values in this exercise are illustrative assumptions, not predictions or qualified allowables.

Model limits

Aligned monodisperse elastic fibers, perfect interface and concentric-cell shear lag. Halpin–Tsai transverse/shear screening closure. Existing constituent data are reused; the short-fiber composite and its strength allowables are a hypothetical teaching system.

Interpret the comparison

Use the model's reported transfer and efficiency outputs to explain the stiffness comparison. Treat any displayed fibre geometry as an illustration unless its dimensions are explicitly part of the calculation. If you save the result as a material, inspect which fields were predicted and which remain blank; an elastic snapshot is not a complete set of qualified material properties.

How information passes between models

Micro → Laminates: Predicted ply stiffness, strength, density and expansion properties.

Materials → Micro: Constituent stiffness, strength, density and thermal / moisture properties.

Mechanical → Simulation: SIMULATION selects this case and its analysis model; the case owns its applicable cycle and input references.

Laminates → Mechanical: Ply angles and thicknesses, stiffness, mass and ply properties.

Geometry → Mechanical: Part shape and dimensions, thickness or section definition, and model-specific geometric inputs. Each selected case consumes only the dimensions its model supports.

Models → Micro: Applied model assignment: Cox shear-lag elastic. Model parameters and formulation are used by Micro.