

Beam Cross-sectional Analysis Capabilities: ABAQUS vs. VABS

The table below compares the sectional analysis capabilities of ABAQUS vis-à-vis the capabilities of VABS. A thorough comparison with results is pending.

	ABAQUS	VABS
Shape of the C/S	Only Box, Pipe, Circular, Rectangular, Hexagonal, Trapezoidal, I, L, T, Arbitrary (multiple segments with piecewise constant thickness, arbitrary orientation), Generalized (specify I_{22} , I_{23} , I_{33} and J from external source for other arbitrary sections). No sketching module provided.	Truly arbitrary geometries accommodated. Modeling of realistic rotor blades only possible through VABS. No need to specify I_{22} , I_{23} , I_{33} and J for any geometry.
Material properties	Elastic - Isotropic / Anisotropic, Hyperelastic, Hypoelastic, Viscoelastic. Plasticity, Damage, Damping also accommodated. Can input temperature dependent data.	VABS hinges on assumption of small strain, so only Elastic - Isotropic, Orthotropic and General Anisotropic (up to 22 constants including density).
Thermal properties	Up to six thermal expansion coefficients can be specified. Can define a heat flux due to internal heat generation through a separate subroutine. Temperature variation interpolated from temperature points.	Up to six thermal expansion coefficients can be specified. Can specify nodal temperatures (output from a heat conduction analysis)
Beam Stiffness Modeling	Euler-Bernoulli beam theory by default. Optional specification of transverse shear stiffness to mimic transverse shear - calculates shear stiffness = shear correction factor $k \times GA$ for standard shapes. Assumed independent of axial stretching and bending. Can specify section Poisson's ratio.	Classical model and/or generalized Timoshenko model (to account for transverse shear). No <i>ad-hoc</i> assumptions of plane sections remaining plane and normal to the beam axis.

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Modeling of Initially Curved / Twisted / Oblique beams	Cannot account for effects of initial twist/ curvature/ obliqueness in either an Euler-Bernoulli or a Timoshenko model	Incorporates Initial Twist/ Curvature effects in classical and generalized Timoshenko models. Models oblique cross-sections for classical beam model
Restrained warping effects	Calculates St. Venant's warping function only for open sections in the standard library of c/s shapes. Not sure if composite thin walled open sections are treated satisfactorily.	A generalized Vlasov model can be obtained for composite beams with significant restrained warping effects.
Recovery of field variables	Cannot recover 3D displacement/strain/stress fields; analysis ends after obtaining 1D quantities.	Possible to recover asymptotically correct 3D stresses, strains and displacements from 1D displacements and sectional resultants, for both isotropic and composite beams
1D Beam analysis	Yes: Euler-Bernoulli / Timoshenko beam analysis	No, but needs to be used in conjunction with a beam analysis code. Not restricted to carryout classical beam analyses - can be used with geometrically exact 1D equations.
Trapeze effect	No such effect is incorporated.	Carries out a nonlinear sectional analysis to incorporate the trapeze effect for beams under large centrifugal forces which effects the torsional rigidity.

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Overall accuracy of results	Very low accuracy for beam analysis, esp. while modeling realistic composite	Very high levels of accuracy - comparable to 3D nonlinear FEA