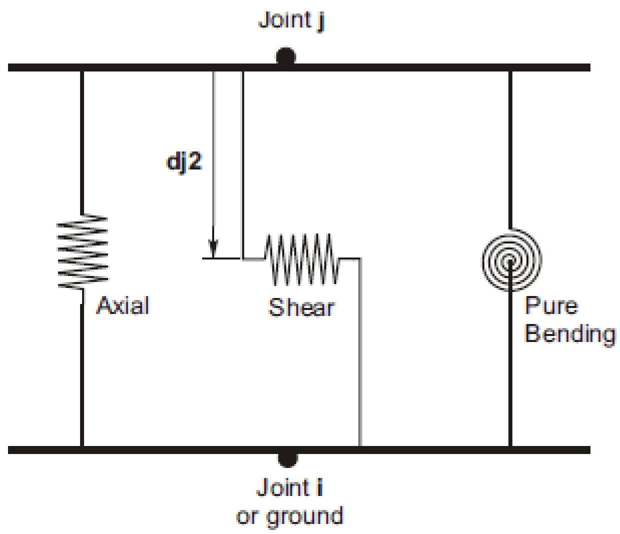
Link

A **link** object connects two joints, *i* and *j*, separated by length *L*, such that specialized structural behavior may be modeled. Linear, nonlinear, and frequency-dependent properties may be assigned to each of the six deformational degrees-of-freedom (DOF) which are internal to a link, including axial, shear, torsion, and pure bending. Internal deformation is then calculated from joint *j* displacement relative to joint *i*, where *i* may be grounded to simulate a support point. To utilize nonlinear and frequency-dependent properties, corresponding analysis cases must be defined and run.



Link force-deformation (F-D) relationships may be specified for each of the 6-DOF to simulate:

- Multi-linear springs (uniaxial elasticity)
- Wen behavior (uniaxial plasticity)
- Kinematic, Takeda, and pivot hysteretic behavior (multi-linear uniaxial plasticity)
- Gap (compression-only) and hook (tension-only) elements
- Isolation devices (biaxial-plasticity and friction-pendulum isolators with optional uplift)

- Viscoelastic damping is specified in Force/Velocity units

All shear deformation is assumed to occur within a shear spring. Shear-spring location may be specified in terms of distance from joint *j*, where dj2 is the major-axis shear-spring location, and dj3, the minor-axis. As such, dj2 represents the location for 1-2 plane shearing and 1-3 plane bending, while dj3 is the reverse. Either translation or rotation may induce shear deformation. Each of the six springs and hinges which correlate with internal link deformation may actually be several coincident components which form a system of springs and dashpots. F-D relationships within a single DOF, or among multiple DOF, may be coupled or independent.

Each F-D relationship is defined within a local coordinate system which is specific to that link. Links may be of zero length, as is the case with links grounded at support points. For dynamic analysis, numerical solution requires that mass *m*, and mass moments of inertia *mr1*, *mr2*, and *mr3*, be assigned to a link such that response captures translational and rotational inertia. Half of each of these values will be assigned to each joint within a link. Internal deformation and internal forces are then reported as output local to each joint. Additional information is available in the CSI *Analysis Reference Manual* (The Link/Support Element Basic, page 229) *and* (The Link/Support Element Advanced, page 253).

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