Documentation for element ***StringPanelLin***:

The **StringPanelLin** element considers a linear-elastic formulation for the quadrilateral shear panel. Currently, the element allows for the input of nonlinear properties in the sections of the stringer, however, this is not yet verified and the current element should be with for linear-elastic sections.

**element StringPanelLin $eleTag $iNode $jNode $knode $lNode $strSecTag1 $strSecTag2 $strSecTag3 $strSecTag4 $E\_p $nu $t <-rho $rho>**

**$eleTag**  unique element object tag

**$eleTag $iNode $jNode $knode $lNode**  corner nodes (counterclockwise)

**$strSecTag1 $strSecTag2 $strSecTag3 $strSecTag4** stringers section tag (counterclockwise)

**$E\_p** modulus of elasticity of panel

**$nu** Poisson’s ratio of panel

**$t** thickness of panel

**$rho (optional)** mass per unit area of panel (default = 0.0)

$jNode

$strSecTag4

$kNode

$strSecTag3

$lNode

$strSecTag2

$strSecTag1

$iNode

Available recorders:

* **forces, force, globalForce, globalForces**
  + Prints the nodal forces counterclockwise in the global coordinate system
* **localForce, localForces, axialForce, axialForces**
  + Prints the forces in the stringers counterclockwise (12 columns, forces shown in sketch in positive sign convention)
* **shearFlow**
  + Prints the shear flow (q, shown positive in sketch)
* **Stiffness**
  + Prints the initial stiffness of the element
* **inertialForce, inertiaForce**
  + Prints the nodal forces counterclockwise in the global coordinate system including the inertial terms

$lNode

$kNode

F11

F10

F9

F8

F7

F6

q

F5

$jNode

F4

$iNode

F12

F3

F2

F1

Notes:

1. This element does not include geometric nonlinearities in its formulation (i.e. P-Delta or Corotational transformations).
2. The element works in 2-dimensional problems (with either 2 or 3 DOF) and in 3-dimensional problems (with 6-DOF).

Example:

element StringPanelLin 1 1 2 3 4 2 2 2 2 4000. 0.2 0.25; # StringPanelLin element with tag 1, corner nodes are 1 2 3 4 counterclockwise, all 4 stringers are assigned with the section with tag 2, the modulus of elasticity of the material of the panel is 4000, Poisson’s ratio of 0.2 and thickness of 0.25.

References:

* Hoogenboom, P.C., & Blaawendraad, J. (2000). *Quadrilateral shear panel.* Engineering Structures, 22(12), 1690-1698.
* Hoogenboom, P. C. (1998). *Discrete elements and nonlinearity in design of structural concrete walls.* Dissertation, Delft University of Technology. ISBN 90-9011843-8.
* Blaawendraad, J., & Hoogenboom, P. C. (1996). *Stringer panel model for structural concrete design.* ACI Structural Journal, 93(3), 295-305.

**Revisions**

**Revision: 1.06** (04/20/2021)

* Fixed outputs when including inertial terms from r1.05

**Revision: 1.07** (04/20/2021)

* Modified computation of generalized strains and resisting force (no change in results for elastic cases).
* Corrected sign output of shear flow.

**Revision: 1.08** (04/27/2021)

* Modified computation of tangent stiffness

**Revision: 1.09** (07/06/2021)

* Added the **inertialForce, inertiaForce** recorder

**Revision: 1.10** (08/12/2021)

* Cleared notes for GitHub
* Stop exiting when transformation to local reference plane is not the same as in the original (could be the case for very irregular quadrilaterals)