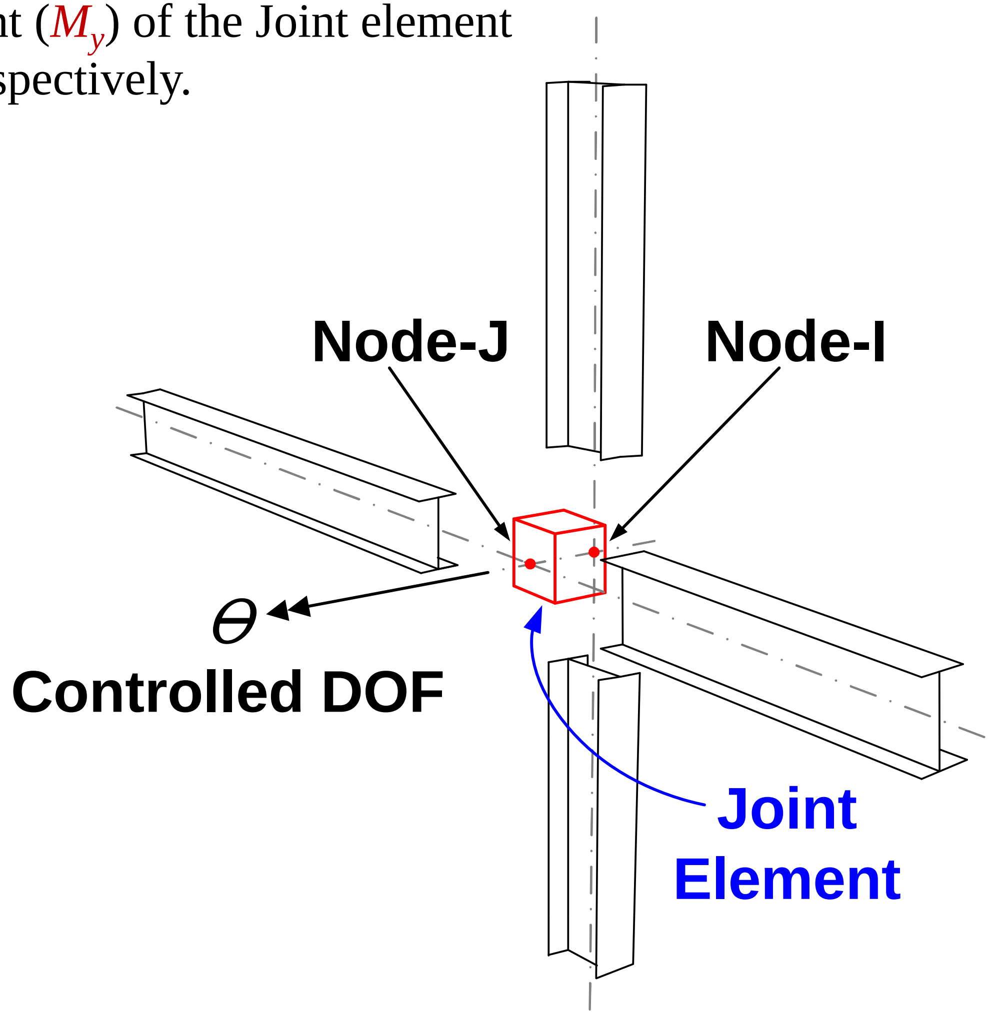
Modeling the panel zone using PISA3D

To model the panel zone with the Joint element in PISA3D, the effective initial rotational stiffness (K_i) and yield moment (M_y) of the Joint element can be obtained from Equations (1) and (2), respectively.

$$K_i = \frac{G d_b d_c t_j}{1 - d_b / h}, \qquad (1)$$

$$M_y = \frac{0.6 F_y d_b d_c t_j}{1 - d_b / h}. \qquad (2)$$



(See manual: G03, Joint Element)

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To define the required properties of the Joint element, you have to specify the effective initial rotational stiffness (K_i) obtained from Equation (1). In addition, the nonlinear material model (e.g., bilinear model), that is assigned to the Joint element, is used to defined the yield moment (M_y). Specifically, according to the M_y obtained from Equation (2) and an assumed Young's modulus (E_i) of its material , the F_y of its material can be obtained with:

$$F_y = \frac{M_y}{\left(K_i / E_i\right)} \quad , \tag{3}$$

where K_i is specified in this element, and E_i is defined in the material. Thus, the yield moment of this joint element calculated in PISA3D is defined as:

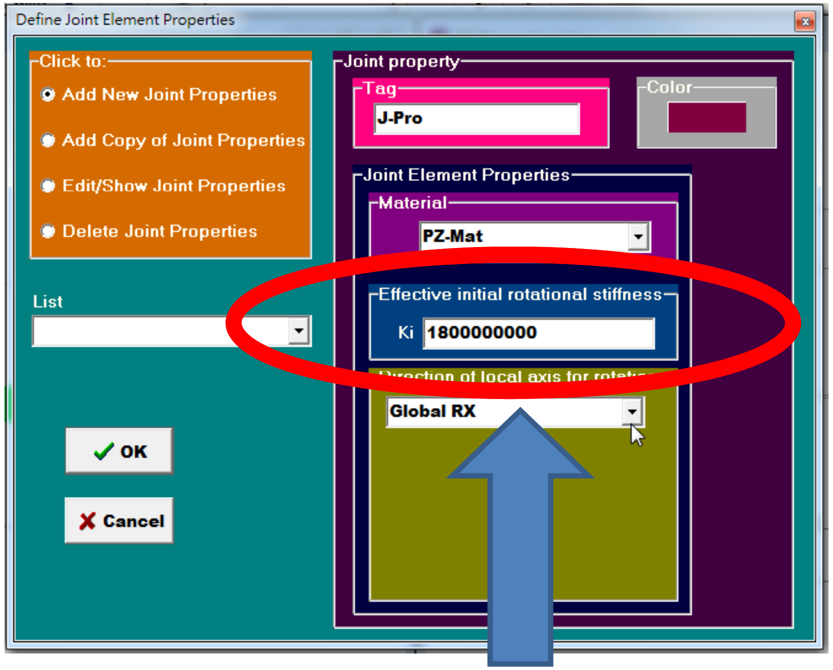
$$M_y = \frac{K_i \times F_y}{E_i} \quad . \tag{4}$$

In short, to model the panel zone effect using PISA3D, you have to define the proper ratio computed by dividing F_y by E_i to make the M_y of Equation (4) equal to the yield moment calculated from Equation (2).

Example for demonstration

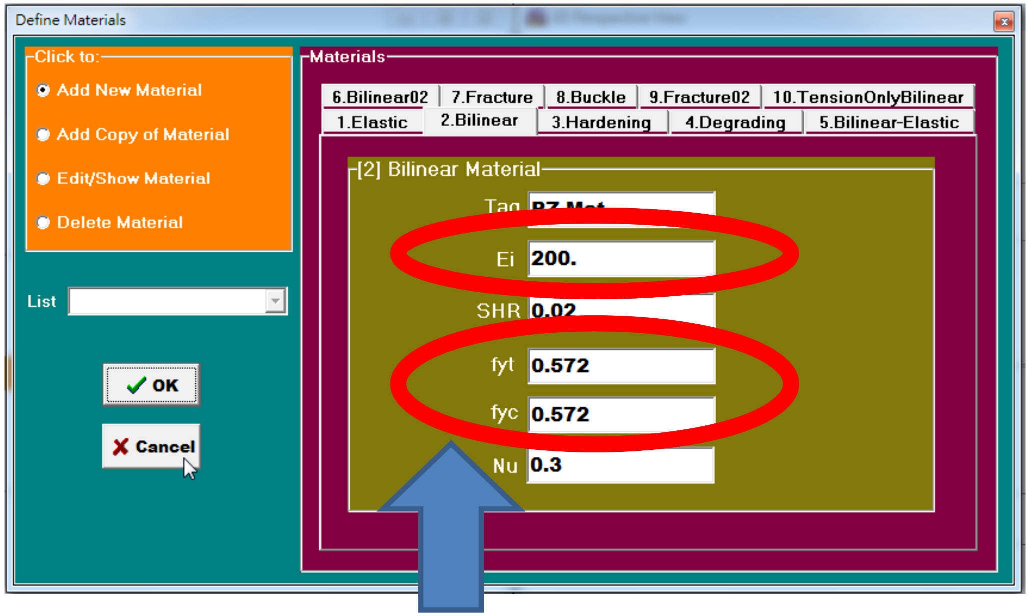
For example, the assumed K_i and M_y of the Joint element, that is used to model a certain panel zone are 1800000,000 kN-mm/radian and 5148,000 kN-mm, respectively. To accommodate the assumed K_i and M_y, the operation demonstrated in the class on April 9, 2018 can be found as follows:

1.Define Joint element properties



K_i = 1800000,000 kN-mm/radian

2.Define Bilinear model properties



F_y / E_i = 0.572/200 = 0.0286

Through the specified K_i, F_y and E_i, the M_y of the Joint element can be set to 5148,000 kN-mm.

$M_y = K_i \times (F_y / E_i)$ = 1800000,000*0.0286 = 5148,000 kN-mm