Moment-Rotation Worksheet for Semi-Rigid Connections:

All values for input and output are in kips and inches.

**Beam Properties:**

- Length of Beam (in) \( L = 600 \)
- Modulus of Elasticity (ksi) \( E = 29000 \)
- Moment of Inertia (in\(^4\)) \( I = 15600 \)
- Depth of Beam (in) \( d_{beam} = 17.7 \)

**Beam Loading Conditions:**

- Beam Load Magnitude:
  - Point load (kip) or Uniform load (kip-in) \( \text{Load} = 0.375 \)  

**Manual Input for Other Beam Loading Conditions (Optional):**

- Fixed-end Beam Moment (kip-in) \( M_{FEM} = 0 \)
- Simply-Supported Beam Rotation (radians) \( \Theta_{SS} = 0 \)
Frye-Morris Beam Rotation Model

User Defined Input Parameters:

Connection Type:

- Double web angles (1)
- Top and seat angles with double web angles (2)
- Top and seat angles (3)
- End plate without column stiffeners (4)
- End plate with column stiffeners (5)
- T-stub (6)

Connection Type = 1

Connection Variables:
(refer to figure for applicable variable definitions, all other variables remain zero)

- $t_a = 0.3125$
- $d_a = 23.5$
- $g = 7.8850$
- $t_c = 0$
- $d_b = 0$
- $l_a = 0$
- $t_p = 0$
- $d_g = 0$
- $l_t = 0$
- $t = 0$
- $d = 0$

All dimensions specified in inches.
Results of Frye-Morris Analysis

Connection Design Values:

- Connection Moment Capacity (kip-in):
  \[ M_{\text{int}} = 1537.5 \]

- Connection Maximum Rotation (radians):
  \[ \Theta_{\text{int}} = 6.441 \times 10^{-3} \]

- Connection Design Stiffness (kip-in):
  \[ R_k = 86722.9 \]
Chen-Kishi Three-Parameter Power Model

User Defined Input Parameters:

**Angle Material Properties:**
- Yield Stress (ksi): \( F_y = 36 \)
- Modulus of Elasticity (ksi): \( E = 29000 \)

**Distance from Angle Heel to Center of Bolt Holes (in):**
- Top and Seat: \( g_{ct} = 3 \)
- Web: \( g_{cw} = 3 \)

**Thickness of Angle Legs (in):**
- Top and Seat: \( t_t = 0.375 \)
- Web: \( t_w = 0.25 \)

**Distance from Angle Heel to Toe of the Fillet (in):**
- Top and Seat: \( k_t = 0.875 \)
- Web: \( k_w = 0.688 \)

**Length of Angle (in):**
- Top and Seat: \( l_t = 7 \)
- Web: \( l_w = 8 \)

**Fastener Nut Diameter (in):**
- Top and Seat: \( W_t = 1.4375 \)
- Web: \( W_w = 1.4375 \)

All dimensions specified in kips and inches.
Single Web-Angle Connections

- Initial Stiffness Calculations
- Ultimate Moment Capacity Calculations
- Shape Parameter Calculations
- Connection Curve and Beam Line Functions

### Output for Single Web-Angle Connections:

- **Initial Connection Stiffness, $R_{ki}$ (kip-in/rad):**
  \[ R_{ki} = 1.544 \times 10^3 \]

- **Ultimate Moment Capacity, $M_u$ (kip-in):**
  \[ M_u = 58.379 \]

- **Shape Parameter, $n$:**
  \[ n = 1.551 \]

- **Reference Plastic Rotation, $\theta_0$ (radians):**
  \[ \theta_0 = 0.038 \]

![Single Web-Angle Beam Rotation Curve](image-url)
Double Web-Angle Connections

- Initial Stiffness Calculations
- Ultimate Moment Capacity Calculations
- Shape Parameter Calculations
- Connection Curve and Beam Line Functions

**Output for Double Web-Angle Connections:**

Initial Connection Stiffness, \( R_{ki} \) (kip-in/rad):

\[ R_{ki} = R_{kiw} = 3.088 \times 10^3 \]

Ultimate Moment Capacity, \( M_u \) (kip-in):

\[ M_u = M_{uw} = 116.758 \]

Shape Parameter, \( n \):

\[ n = 2.072 \]

Reference Plastic Rotation, \( \theta_0 \) (radians):

\[ \theta_0 = 0.038 \]

Double Web-Angle Beam Rotation Curve
Top- and Seat-Angle Connections

- Initial Stiffness Calculations
- Ultimate Moment Capacity Calculations
- Shape Parameter Calculations
- Connection Curve and Beam Line Functions

Output for Top- and Seat-Angle Connections:

Initial Connection Stiffness, \( R_{ki} \) (kip-in/rad):
\[ R_{ki} = R_{kit} = 9.293 \times 10^4 \]

Ultimate Moment Capacity, \( M_u \) (kip-in):
\[ M_u = M_{ut} = 288.059 \]

Shape Parameter, \( n \):
\[ n = 1.045 \]

Reference Plastic Rotation, \( \theta_0 \) (radians):
\[ \Theta_0 = 3.1 \times 10^{-3} \]
Top- and Seat- with Double Web-Angle Connections

- Initial Stiffness Calculations
- Ultimate Moment Capacity Calculations
- Shape Parameter Calculations
- Connection Curve and Beam Line Functions

**Output for Top- and Seat- with Double Web-Angle Connections:**

- **Initial Connection Stiffness,** $R_{ki}$ (kip-in/rad):
  \[ R_{ki} = 1.075 \times 10^5 \]

- **Ultimate Moment Capacity,** $M_u$ (kip-in):
  \[ M_u = 605.774 \]

- **Shape Parameter, n:**
  \[ n = 2.412 \]

- **Reference Plastic Rotation, $\theta_0$ (radians):**
  \[ \theta_0 = 5.633 \times 10^{-3} \]

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**Top- and Seat- with Double Web-Angle Beam Rotation Curve**

![Beam Rotation Curve](image-url)