

Example 27: Verifying moments in an unsymmetrical closed frame

1 Description of the problem

To verify the mathematical model of *ELPLA* for analyzing unsymmetrical closed frames, moments in an unsymmetrical closed frame introduced by Wang (1983), Example 15.10.1, page 574 are compared with those obtained by *ELPLA*.

An unsymmetrical closed frame *ABCD* is considered as shown in Figure 64. The frame is subjected to a point load of $P = 24$ [kN] at the center of the member *BC* and a distributed load of $q = 2$ [kN/m] on the member *AD*.

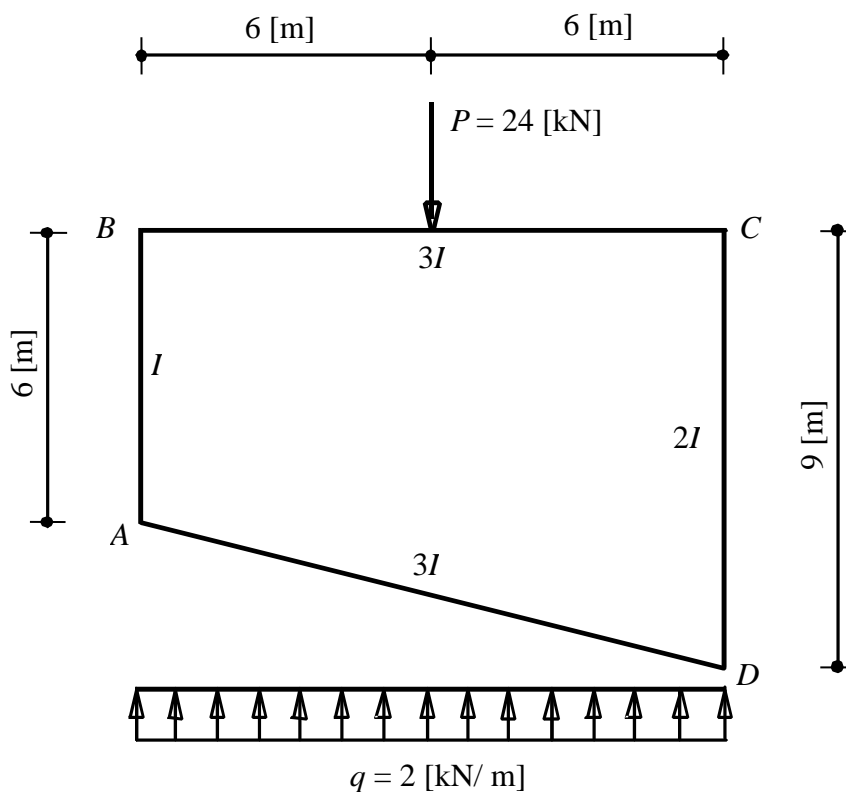


Figure 64 Unsymmetrical closed frame with dimensions and loading

Members have three types of cross sections, which yield moments of Inertia I , $2I$ and $3I$ as shown in Figure 64. Chosen moment of inertia for each type and its corresponding cross section area is listed in Table 37. *Young's* modulus of the frame is assumed to be $E_b = 2.0 \times 10^7$ [kN/m²].

Table 37 Properties of member types

Member type	Moment of Inertia [m ⁴]	Cross section area [m ²]
Type 1	0.001	0.032
Type 2	0.002	0.045
Type 3	0.003	0.055

2 Comparison of moments

Moments at points *A*, *B*, *C* and *D* obtained by *ELPLA* are shown in Figure 65 and compared with those obtained by *Wang* (1983) in Table 38. Both moments are in a good agreement.

Table 38 Comparison of moments obtained by *ELPLA* with those obtained by *Wang* (1983)

Point	Moment [kN.m]			
	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>
<i>Wang</i> (1983)	-8.50	-14.90	-19.49	-9.89
<i>ELPLA</i>	-8.51	-14.89	-19.47	-9.90

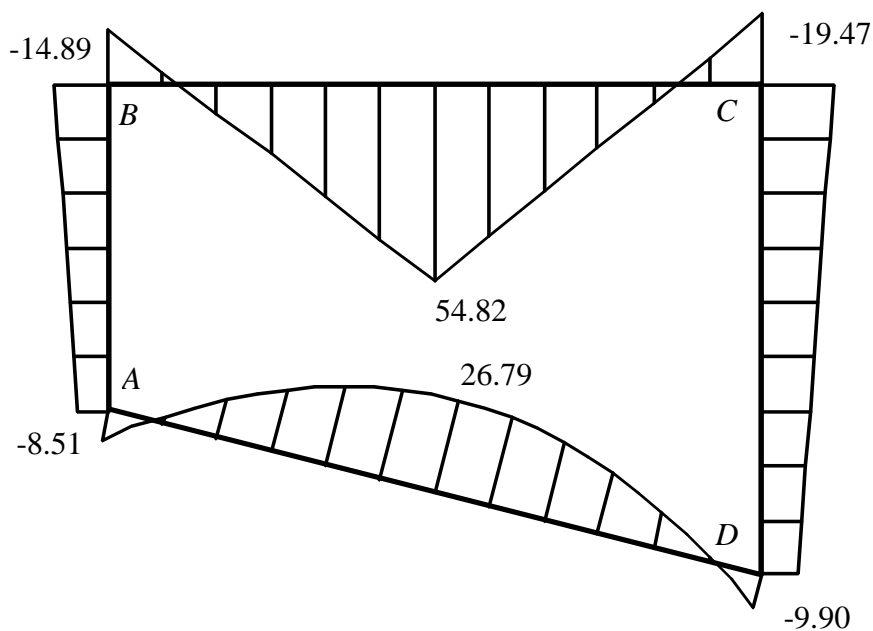


Figure 65 Moments in the unsymmetrical closed frame obtained by *ELPLA*