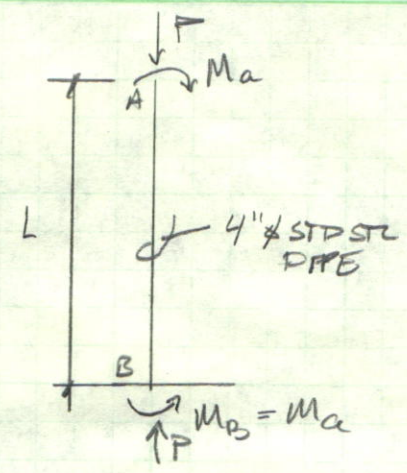


SECOND ORDER ANALYSIS EXAMPLE

$P = 500\#$        $I = 6.82 \text{ in}^4$   
 $M_A = 1'K$   
 $L = 15'$



LOADS ON UNDEFLECTED SHAPE

ON UNDEFLECTED SHAPE:

$M_B = M_A$

DEFLECTION @ A DUE TO MOMENT,  $M_A$

$$\Delta_0 = \frac{M_A L^2}{2EI} = \frac{1000\# (15')^2 (1728 \text{ in}^3/\text{ft}^3)}{2 (29 \times 10^6 \#/\text{in}^2) (6.82 \text{ in}^4)} = .983''$$

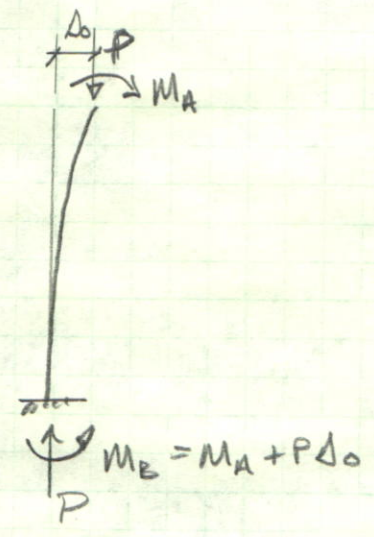
RECOMPUTE  $M_B$

$$M_B = M_A + P \Delta_0$$

$$= 1000\# + 500\# \left( \frac{.983}{12} \right)$$

$$= 41.0\#$$

$M_B = 1041\#$



THIS CAUSES ADDITIONAL DEFL:

$$\Delta_T = \Delta_0 + \Delta_1 = \frac{(M_0 + M_1) L^2}{2EI} \rightarrow .0403 = \Delta_1$$

$$\Delta_T = .983'' + \frac{41.0\# (15')^2 (1728)}{2 (29,000,000) (6.82)}$$

$\Delta_T = 1.023''$

RECOMPUTE  $M_B$

$$M_B = M_0 + M_1 + P \Delta_1$$

$$= 1041\# + 500\# (.0403'')$$

$M_B = 1.68\#$

RECOMPUTE  $\Delta$  . . . . .

RECOMPUTE  $M_B$  . . . . .

UNTIL  $\Delta_i$  &  $M_i$  ARE VERY SMALL

SAME PROBLEM USING A TABLE:

STAGE	STAGE MOMENT $M_i$ (FT-#)	$M_B$ (PT-#)	STAGE DEPL $\Delta_i$ (IN)	$\Delta A$ (IN)
0	1000	1000	.983	0.983
1	41.0	1041.0	.0403	1.023
2	1.68	1042.6	$1.65 \times 10^{-3}$	1.025
3	$68.7 \times 10^{-3}$	1042.9	$67.5 \times 10^{-6}$	1.025

CHANGES ARE INSIGNIFICANT AFTER  
2<sup>ND</sup> STAGE  $\therefore$  CONVERGED

INCREASE IN MOMENT DUE TO 2<sup>ND</sup> ORDER EFFECTS:

$$\frac{1044.3 - 1000}{1000} = \underline{\underline{4.43\%}}$$