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Equation Method for Continuous Beam to Determine the Reaction in Supports

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ABSTRACT: Equation method is used for find out the reaction in the supports of continuous beam after determinations of moment at the supports by force or displacement methods. In this method the reaction can easily applying in two to three unknown reactions by ordinary simultaneous method or simply using scientific calculator. If the vertical reaction at supports are greater than three is determining by using Gauss-Jacobi and Gauss-Seidel iteration Method.

I. INTRODUCTION

Equation method is very useful to reduce the calculation for finding reaction at the supports after determinations of moment at the supports by force or displacement methods in continuous beam. In this method the equations are solved easily by scientific calculator having two to three unknowns. Reduce the numerical steps in calculation for finding the reactions in beam.

II. METHODOLOGY

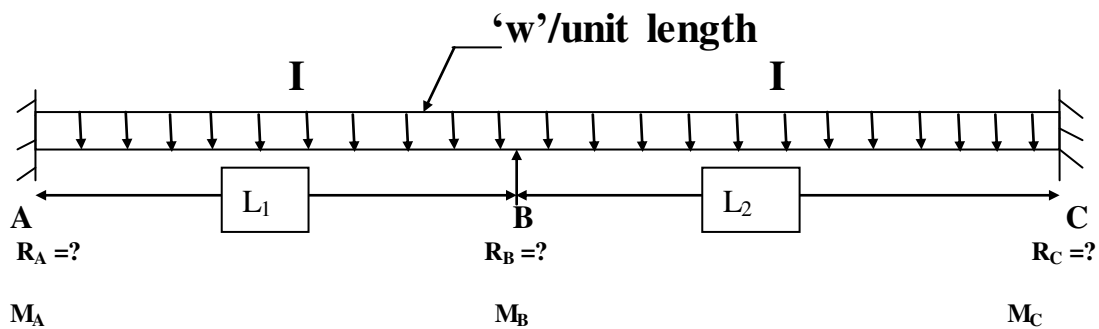


fig (i)

M_A = Moment at A , M_B = Moment at B and M_C = Moment at C
 R_A = Reaction at A, R_B = Reaction at B and R_C = Reaction at C

Above fig (i) is two span continuous beam after analysing by any one of force or displacements method to determined the value of moment in supports. From the value of moment at intermediate support 'B' to find out the reaction at supports by taking moments about support 'B' and 'A' or 'B'.

Taking moment about 'B' to find R_C :

$$M_B = R_C \times L_2 - (w \times (L_2)^2 / 2) - M_C$$

$$R_C \times L_2 = M_B + M_C + (w \times (L_2)^2 / 2)$$

$$0 R_A + 0 R_B + R_C \times L_2 = M_B + M_C + (w \times (L_2)^2 / 2) \dots\dots\dots (1)$$



Taking moment about 'B' to find R_A :

$$M_B = R_A \times L_1 - (w \times (L_1)^2 / 2) - M_A$$

$$R_A \times L_1 = M_B + M_A + (w \times (L_1)^2 / 2)$$

$$R_A \times L_1 + 0 R_B + 0 R_C = M_B + M_A + (w \times (L_1)^2 / 2) \dots\dots\dots(2)$$

Taking moment about 'A' to find R_B :

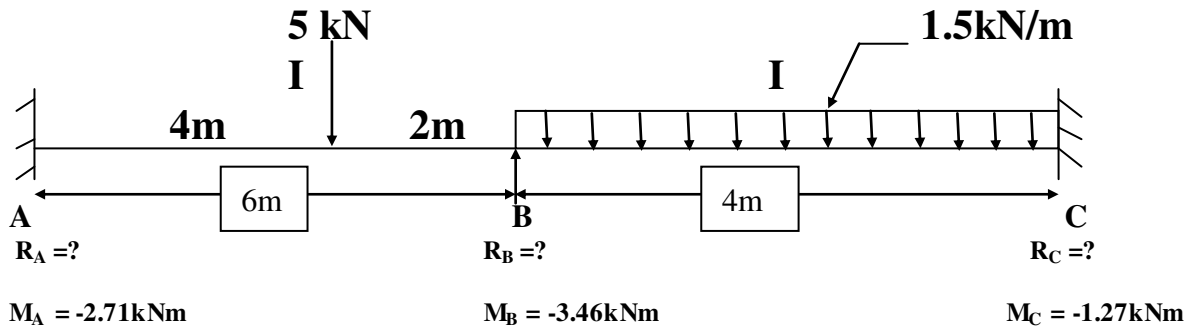
$$M_A = R_C \times (L_1 + L_2) - (w \times (L_1 + L_2)^2 / 2) + R_B \times L_1 - M_C$$

$$0 R_A + R_B \times L_1 + R_C \times (L_1 + L_2) = M_A + (w \times (L_1 + L_2)^2 / 2) + M_C \dots\dots\dots(3)$$

We know the value of M_A = Moment at A, M_B = Moment at B, M_C = Moment at C , w = Load/unit length, L_1 = Span1 and L_2 = Span 2

The equations are easily solving by simultaneous equation method or simply by using scientific calculator. If the vertical reaction at supports are greater than three is determining by using Gauss-Jacobi and Gauss-Seidel iteration Method (Continuous beam have more than two supports).

III. EXPERIMENTAL RESULTS



M_A = Moment at A, M_B = Moment at B and M_C = Moment at C
 R_A = Reaction at A, R_B = Reaction at B and R_C = Reaction at C

Taking moment about 'B' to find R_C :

$$M_B = R_C \times L_2 - (1.5 \times (L_2)^2 / 2) - M_C$$

$$-3.46 = 4 R_C - 1.5 \times 16 / 2 - 1.27$$

$$0 R_A + 0 R_B + 4 R_C = 9.81 \dots\dots\dots (1)$$

Taking moment about 'B' to find R_A :

$$M_B = R_A \times L_1 - (W \times 2) - M_A$$



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$$-3.46 = R_A \times 6 - 5 \times 2 - 2.71$$

$$6R_A + 0 R_B + 0R_C = +9.25 \dots\dots\dots(2)$$

Taking moment about 'A' to find R_B:

$$M_A = R_C \times (6+4) - (1.5 \times 4 (2+6)) + R_B \times 6 - 1.27 - 5 \times 4$$

$$0 R_A + 6R_B + 10R_C = 66.56 \dots\dots\dots(3)$$

Solving equation 1,2 and 3 we get

R_A = 1.54kN, R_B = 7.01kN & R_C = 2.45kN
 (by using scientific calculator)

CHECK:

$$\begin{aligned} R_A + R_B + R_C &= \text{TOTAL LOAD ACTING ON THE BEAM} \\ 1.54 + 7.01 + 2.45 &= (1.5 \times 4) + 5 \\ 11 &= 11 \end{aligned}$$

Hence o.k.

IV. CONCLUSION

This is also simple method for find out the reaction for continuous beam having two spans. A beam having more than two spans the equations are solved by crammers rule, Gauss-Jacobi and Gauss-Seidel iteration Method. This method have great disadvantages for determining the reactions to beam have more than two span is more tedious and waste of time.

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