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Analysis beams have two and above triangular loads

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Abstract
The aim of this study is to find out a new method of determinant beam analysis, which is effective to analyze beams which are not analyzed by the other methods. The study is started by introducing analysis by part and finding out its limitations. Finally by conceptualizing this problem the paper adds some geometric views to the equilibrium method of analysis and develops a new method of analysis. The paper introduces this method by showing its validity with examples.

Keywords: Superposition, shear, bending moment, critical points, analysis by part.

1. Introduction

We have introduced to technics of determinate beam analysis like equilibrium method and analysis by part are the two known methods. Equilibrium method of analysis is the method which is widely used for analysis purpose. But analysis using this method alone sometimes leads to complex situation. In order to avoid this complexity analysis by part adds some technic to equilibrium method. Analysis by part is the method which said that When a beam is subjected to several loads, it is usually convenient to determine the reaction, shear and flexural force (beading force) caused by a combined effect of loads by superimposing (algebraically) or algebraically subtracting the reaction, shear and bending due to each of the loads acting individually on the beam. The reaction, shear and bending moment due to each individual load can be computed by using the elementary analysis as we know previously (usual approach). Also we can use many structural engineering hand books or templates which are prepared for a given geometry and specific load arrangement like beam design formulas with shear and moment diagrams by the American wood council (AWC) contains formulas of various arrangement of loads with their reaction, shear and beading moment diagrams which can be used for this purpose.

But also using this technics is sometimes difficult to analysis the beam which has different load arrangements especially beam with two or more triangular load arrangement. The aim of this paper is to over-come this problem and to introduce alternative method of beam analysis.

Beam Analysis by Part

In beam analysis if the load arrangement of a given beam can be separated in to two or more arrangement of loads without altering the support condition and beam parameters. In this

case the values of reaction, shear diagram and beading moment diagram can be calculated by adding or subtracting each arrangement of sub-division loads.

When abeam are subjected to different types of loads, such as a combination of distributed and concentrated loads, determination of the properties of the resultant reaction, shear and moment diagram, due to the combined effect of all the loads, can become a formidable task. This difficulty can be avoided by constructing the reaction, shear and beading moment diagram in parts. That is by constructing a separate shear and beading moment diagrams thus obtained from each part are added and gives the shear and beading moment diagram at each point.

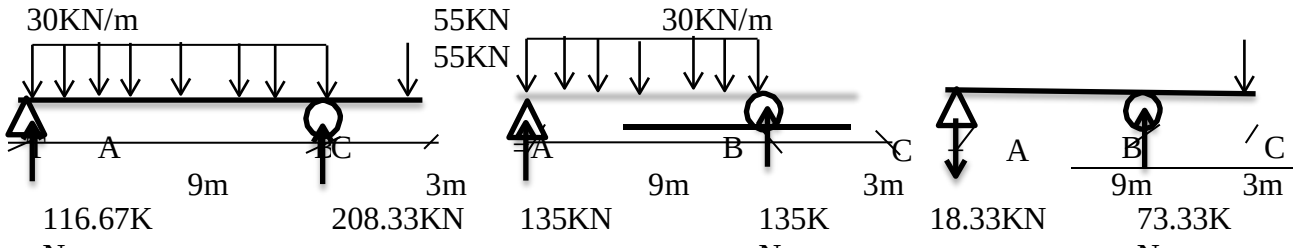


Fig-1a Load arrangement and reaction by parts

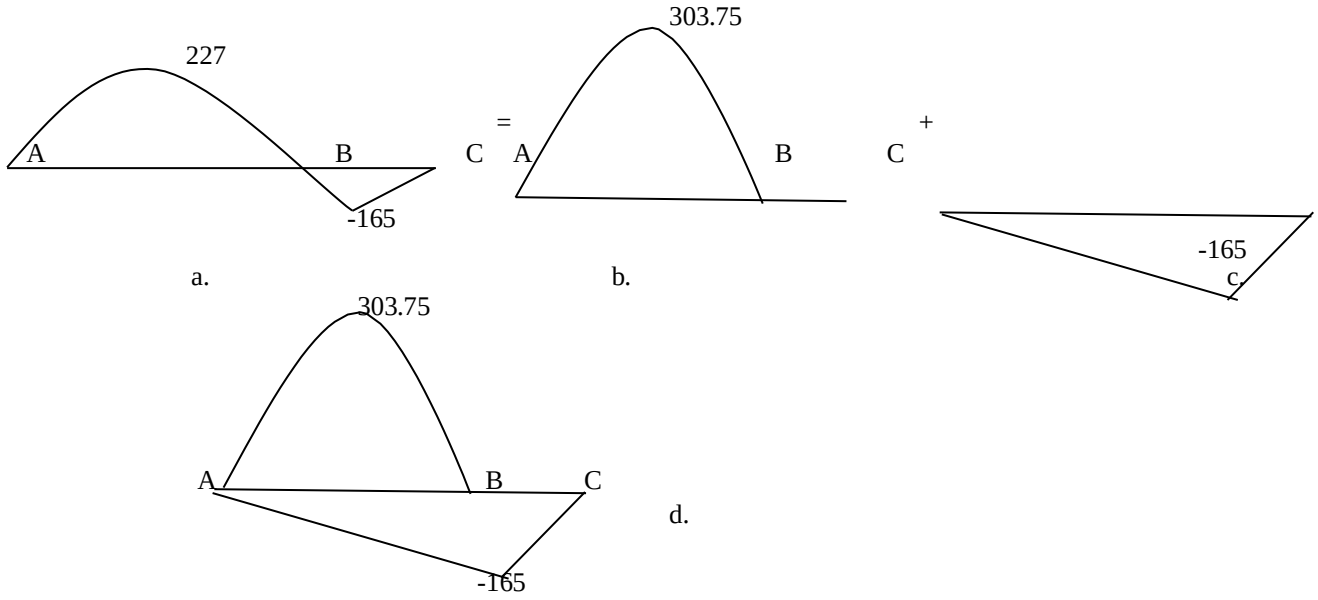


Fig-1B Beading moment diagram by parts

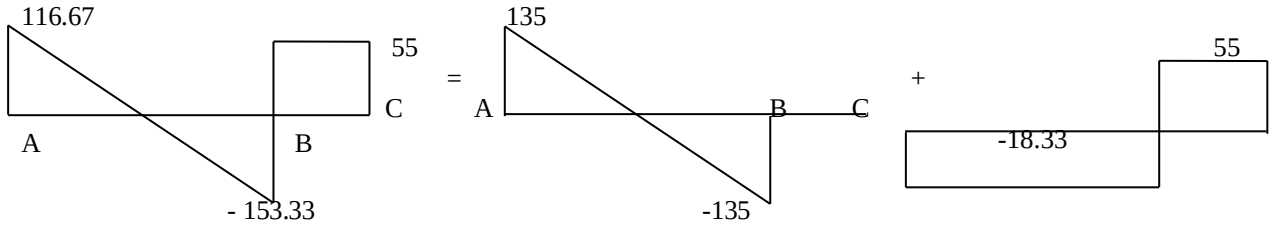


Fig-1C Shear force diagram by parts two procedures are commonly used for constructing bending moment diagrams and shear force diagrams by parts. The first procedure simply involves applying each of the loads separately on the beam and constructing the corresponding beading moment diagrams. Consider for example a beam subjected to a combination of a uniformly distributed load and a concentrated load, as shown the fig above a. To construct the beading moment diagram by part, we apply the two types of loads separately on the beam as shown above b and c and draw the corresponding bending and shear diagrams. It is usually convent to draw the corresponding the parts of the beading moment and shear diagram together as shown in the fig d above. However the resultant beading moment and shear diagram as shown in the fig a can be obtained by superimposing the two parts as shown in the fig b and c above.

2. Objective of This Study

To find-out alternative method of beam analysis. To minimize the complex analysis situation by providing alternative methods

To indicate different structural analysis software's like SAP, ETABES to include the system of analysis for some beam structures with different load arrangement.

3. Materials

The study relates to abeam made from Homogeneous, continuous, isotropic and elastic material with constant thickness so that it has constant yang's modulus of elasticity E.

4. Research Approach and Methods

In beam analysis especially beams with two or more triangular load arrangement can be separated in to two or more individual sectioned beam with one specific arrangement of loads without altering the support condition and beam parameters. In this case the values of reaction, shear diagram and beading moment diagram can be calculated by analysis each section beam as independent beam.

When a determinate beam is subjected to several types of load distributions such as combination of two or more types of triangular distribution as shown in the fig bellow it is sometimes difficult to determine the shear force and bending moment diagram due to combined effect of a given load distribution of abeam as usual equilibrium techniques. Such type of beam can be analyzed by section abeam at the critical point after the determination of reactions of abeam. Then the bending moment and the shear force diagram can be drawn as independent beam using the shear and flexural moment at the critical point as reaction.

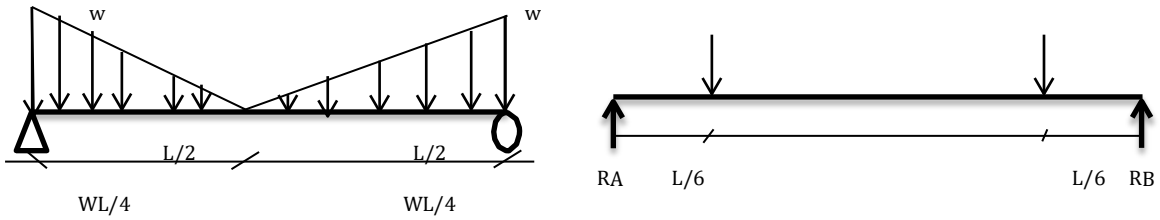


Fig-2 abeam with triangular load arrangement.

EMA=0

RB*L-(WL/4*L/6+WL/4*5L/6) =0

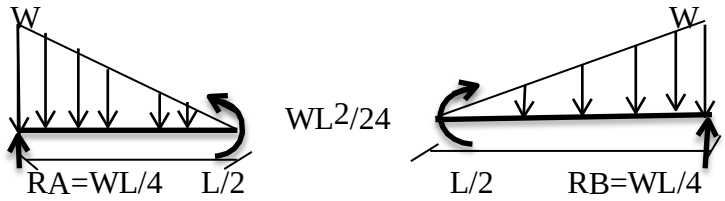
RB*L-WL/4(L/6+5L/6) =0 RB*L-WL^2/4=0
RB=WL/4

EFY=0
RA+ RB -WL/4-WL/4=0 RA+ WL/4 -WL/4-WL/4=0
RA=WL/4

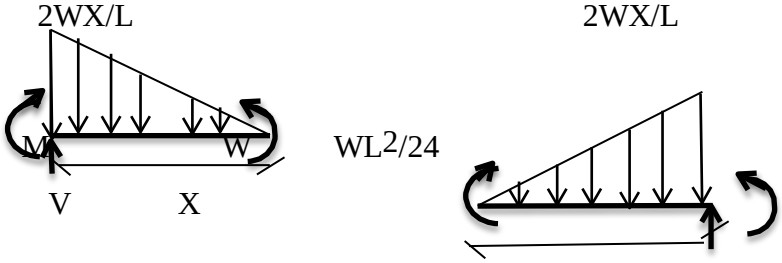
Shear and moment at a critical pointes

EMC=0
WL/4*L/2-WL/4*L/3-MC=0 WL/4*L/2-WL/4*L/3-MC=0 MC=WL^2/8-WL^2/12
MC=WL^2/24

The by section the beam and use the shear and bending Moment as reaction. Analysis beams as independent one.



Then by section the beam and use the shear and bending moment as reaction. Analysis beams as independent.



EFY=0
V-1/2*2WX/L*X=0 V=WX2/L
EM=0
WL2/24-WX2/L*X/3-M=0 M=WL2/24-WX3/3L

EFY=0
-V-1/2*2WX/L*X=0 V=-WX2/L

EM=0
-WL2/24-WX2/L*X/3+M=0 M=WL2/24+WX3/3L

As a function of global coordinate

For 0<X<L/2 V=W/L*(L/2-X)2 M=WL2/24-W/3L*(L/2-X)^3 For L/2<X<L
V=-W/L*(L/2+X)^2 M=WL^2/24+W/3L*(L/2+X)^3

Cheek the analysis using principles of supper-position

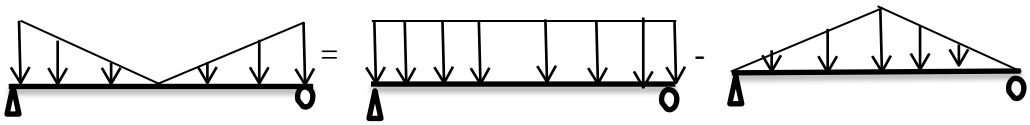


Fig-3 analysis by the principles of superposition

For uniformly loaded beam

$V=WL/2-WX$ $M=WLX/2-WX^2/2$

For triangular loaded beam

$V=WL/4-WX^2/L$ $M=WLX/4-WX^3/3L$

For the required loaded beam

$V= WL/2-WX- (WL/4-WX^2/L)$ $V= WL/2-WX- WL/4+WX^2/L$

$V= WL/4-WX+WX^2/L$

$V=W/L*(L/2-X)^2$

$M= WLX/2-WX^2/2-(WLX/4-WX^3/3L)$ $M= WLX/2-WX^2/2-WLX/4+WX^3/3L$ $M= WLX/4-WX^2/2+WX^3/3L$ $M=WL^2/24-W/3L*(L/2-X)^3$

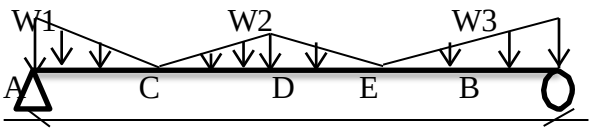
Determine the critical points

In this method of analysis the determination of the critical point is the basic concept. It usually occurs at the intersection point of two different load arrangements. But every point we obtained at the intersection point are not usually important. Example as we see from the bellow fig 4 it has 3 critical points. At point C, D&E. But this all three points are not important. Only the one point C is only essential but the other points D&E are optional same part of the beam in this load arrangement are analyzed asymmetric.

Determination of shear force bending moment at a critical point is the next step. After that the shear force and bending moment diagram is drawn by using shear and bending moment at Particular point as reaction and draw the diagram consecutively by using the beam with a regular load arrangement and the shear and bending moment at the critical points as reaction.

5. Results And Discussions

The method may be used for all of load arrangement and any support condition. Sometimes ASB with the combination of analysis by parts it is very effective. Invest it is the only means to analysis beams with two or more triangularly, trapezoidal or uniform load avengement. In vast for symmetric load arrangement of beams part of the beam is analyzed by this method and the rest part is analyzed by considering the symmetric concepts. Example the following diagrams are some of the beams which vastly and effectively analyses by the method of section.



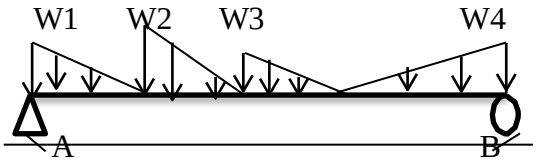


Fig-4 Some of beams which effectively analyzed by method of section.

6. Conclusions and Recommendations

From the research the following conclusions have been made.

a. Introduce a new approach to analysis of determinate beam which may be difficult to analyze using equilibrium method and analysis by part.
b. Introduce alternative method of analysis of a determinate beam which combines with the other methods make the analysis essay.
c. Has great role of analysis for academicals purpose.

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