8th World Congress on Computational Mechanics (WCCM8)
"5th European Congress on Computational Methods in Applied Sciences and Engineering(ECCOMAS 2008)"

JUNE 30- JULY 5, 2008 Venice/ ITALY

DYNAMIC ANALYSIS OF OVERHEAD CRANE BEAMS UNDER MOVING LOADS

İsmail GERDEMELİ	Derya OZER	İsmail ESEN
ITU, Faculty of Mech. Eng. Mech.Eng. Department	ITU, Faculty of Mech.Eng. Mech.Eng. Department	ITU, Faculty of Mech.Eng. Mech.Eng. Department
Gumussuyu, 34437 Istanbul, Turkey	Gumussuyu, 34437 Istanbul, Turkey	Gumussuyu, 34437 Istanbul, Turkey

Keywords: Overhead Crane Beams, Moving Loads, Dynamic Response

ABSTRACT

In this study, dynamic behaviour of Overhead Crane beams is investigated. An Bernoulli-Euler thin beam is studied. Computerized analysis was carried out in SAP 2000. Dynamic response of the beam was obtained depending on the mass ratio of the load to the mass of the beam and the velocity of the load. Dynamic response of crane beams depends on velocity and mass of moving load. Since the position of the mass of moving load changes, it causes changes in the natural frequency of the system. While the load is moving, depending on the position of the mass of load the vibration of the system varies. Genarally, If the velocity of the load increases, the position of the maximum response on the beam occurs far from the midpoint. At very high speeds the maximum deflection of the beam occurs close to the end of the beam. For some values of the velocity the maximum response may occur before the middle of the beam. At very slow speeds maximum deflection of the beam occurs near the middle of the beam because the system reduces to a quasi-static solution. Analysis carried out the mass ratios(mass of the load/mass of the beam m/M) 0.2, 0.5 and 0.8 and for load velocities 0.01, 0.5, 1.25, 2.5, 4, 5 and 6.25 m/s. For same mass ratio when the velocity of the load increases, the deflection of the beam goes higher. The dynamic behaviour of the beam more affected from the velocity of load than mass ratio of the system. It is showed that carrying analysis in terms of only the midpoint deflection or midpoint stresses in engineering calculations of the beam systems is insufficient. It brings out more accurate results to take into account the mass and velocity of the moving load and dynamic properties of carrying system in dynamic analysis. The overhead crane beam was modelled as shown in Fig. 2 . The beam carries a moving carriage. A mass is attached to the carriage by a massless rigit rod. The carriage is assumed as a point mass. The payload mass is lifted by a cable system. In actual systems, the cables are not rigit. Since the oscilating moving mass is not the subject of this study, to make a simplification we assumed the cables as rigit rod. In this article, [4] it is

given that in the case of infinite spring coefficient ,the moving oscilator problem can be assumed as moving mass problem. So, the total moving mass is assumed as the total mass of the carriage and the payload mass.

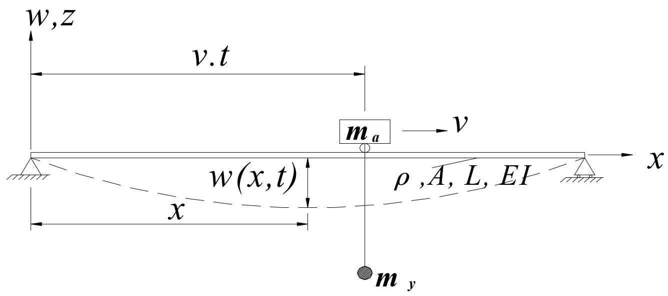

Figure 2. The model of an overhead crane beam under moving load.

ρ	8000 kg/m^3
E	2,117 x 10^{11} N/m^2
L	10 m
A	16 x 10^{-4} m^2
I	2,133 x 10^{-7} m^4
g	9,81 m/s^2
ρAL	128 kg
μ	12,8 kg/m

Table 1. Material Properties of the beam

References

[1] Fryba, L., (1999). Vibration of Solids and Structures under Moving Loads. Groningen: Noordhoff International.

[2] Wu, J.J., Whittaker, A.R. ve Cartmell, M.P., (2000). The use of finite element techniques for calculating the dynamic response of structures to moving loads, *Computers and Structures* **78** ,789-799,

[3] Wilson, E.L., (2002) Static and Dynamic Analysis of Structures, Chapter 20: "Dynamic analysis by numerical integration",Computers and Structures Inc.

[4]Yang, B., Tan, C.A. ve Bergman, L.A. (2000). Direct numerical procedure for solution of moving oscillator problems, *Journal Of Engıneerıng Mechanıcs* **May**, 462-469.

[5]Foda, M.A. ve Abduljabbar, Z., (1998). A dynamic green function formulation for the response of a beam structure to a moving mass, *Journal of Sound and Vibration,* **210,** 3, 295-306.