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Coupled Field Analysis of a Chimney Used in Cement Industry

Shrikant D Rajput[1], Vaibhav Bankar[2]
[1]*Researcher, M. Tech. in (CAD/CAM) (CBCS), Mechanical Engineering Department , Vidarbha Institute of Technology , Nagpur , Maharashtra.*
[2]*Assistant Professor, Mechanical Engineering Department, Vidarbha Institute of Technology, Nagpur, Maharashtra.*

***Abstract:** Chimney, which shape the ultimate factor of a machine using a flue fuel consisting of boiler, play a vital function in maintaining performance, draft, and many others, of a gadget and additionally in minimizing the atmospheric pollution. Metal chimneys also are called steel stacks. The metallic chimneys are product of metal plates and supported on basis. The steel chimneys are used to get away and disperse the flue gases to this sort of height that the gases do not contaminate surrounding. In this thesis, chimney can be designed thinking about dead load and wind load. The bureau of Indian requirements (BIS) layout codes techniques can be used for the design of the chimney. The chimney turned into considered as a cantilever beam with annular cross segment. 3-D version of the chimney is finished in pro/engineer and matched area analysis is accomplished on the chimney in ANSYS. A simplified model of chimneys with various thicknesses like 10mm, 12mm, 14mm and 16mm were modeled environment.*

***Keywords:** Chimney, Flue Gases, Coupled Field Analysis*

I. INTRODUCTION

Chimneys or stacks are very critical business systems for emission of poisonous gases to a better elevation such that the gases do no longer contaminate surrounding ecosystem. These systems are tall, narrow and generally with round move-sections. Distinctive creation substances, together with concrete, steel or masonry, are used to construct chimneys. Metal chimneys are ideally suited for process paintings in which a quick heat-up period and coffee thermal capability are required. Additionally, metallic chimneys are affordable for height up to 45m. Fig. 1 suggests a photograph of self-supporting metal chimneys located in commercial plant.

Fig. 1. Self supported steel chimneys located in industrial plant

II. PROBLEM DESCRIPTION & METHODOLOGY

The goal of this assignment is to make a 3-d model of the chimney and examine the thermal and static behavior of the chimney by appearing the finite element analysis. 3-D modeling software (pro-engineer) turned into used for designing special geometries (10mm, 12mm, 14mm and 16mm thickness) and evaluation software program (ANSYS) become used for thermal and static analysis. The technique accompanied within the assignment is as follows:

1) Create a 3D version of the steam chimney using parametric software program pro-engineer.
2) Perform thermal evaluation and linear layer thermal analysis on the chimney for thermal loads, to find out the temperature distribution and heat flux
3) Perform static analysis and linear layer static evaluation at the chimney for thermal hundreds, to find out the deformation, strain and strain distribution

III. LITERATURE REVIEW

A. Menon and Rao (1997) reviews the code measures to estimate the across wind response of reinforced concrete chimney. In this paper, the difficulties in the coal evaluation of across wind moments and load factor provisions are examined through reliability approach. This paper mainly suggests that it is essential to design at certain conditions for the across wind loading [3].

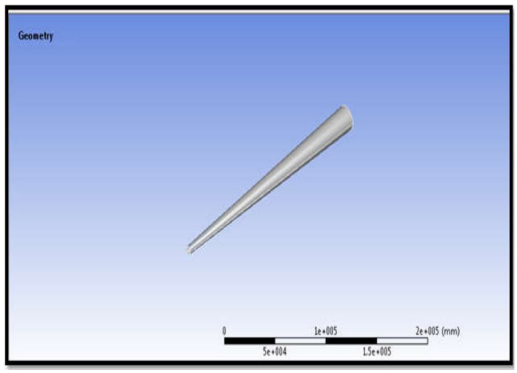
B. K.R.C. Reddy, O.R .Jaiswal and P.N. Godbole (2011) discusses about wind and earthquake evaluation of tall strengthened concrete chimney. In this paper two bolstered concrete chimneys are analyzed for wind and earth quake masses. Earth quake analysis is done as according to is 1893 (part 4): 2005 and wind evaluation is finished as in line with is 4998 (component 1): 1992. The combination of along & across wind hundreds of chimney is carried out as in step with aci 307-ninety eight code. Subsequently, they computed the governing load for design of chimneys.

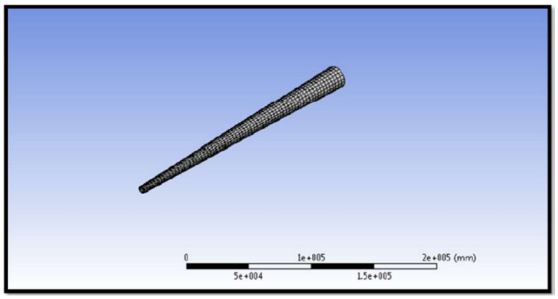
C. B. SivaKonda Reddy, C.Srikanth, V.RohiniPadmavathi (2012) Discusses approximately wind load consequences on tall reinforced concrete chimneys. On this paper they taken into consideration 275m reinforced concrete coated chimney. The take a look at of this paper is alongside &throughout wind results in this rcc chimney for i and vi wind zones of india. In the end, they concluded that, for wind zone –i throughout wind masses are governing and for wind quarter-vi alongside wind loads are governing as opposed to the across wind masses.

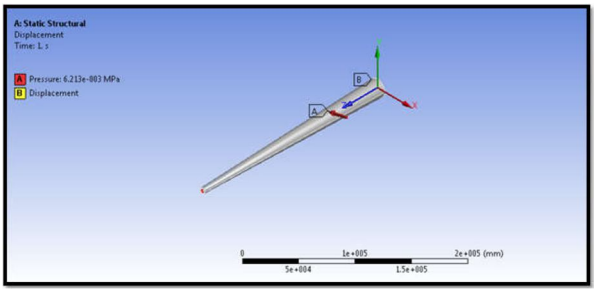
IV. MODELLING AND ANALYSIS

A. Models of slim plate the use of seasoned-e wildfire five.0 the vertical slender plate is modeled using the given specifications and design method from records book. The isometric view of vertical slender plate is proven in under figure. The vertical narrow plate profile is sketched in sketcher after which it is extruded vertical slender plate the use of extrude option.

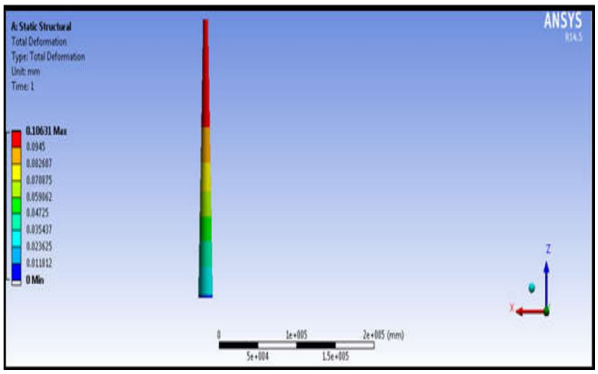
A. Material –Concrete



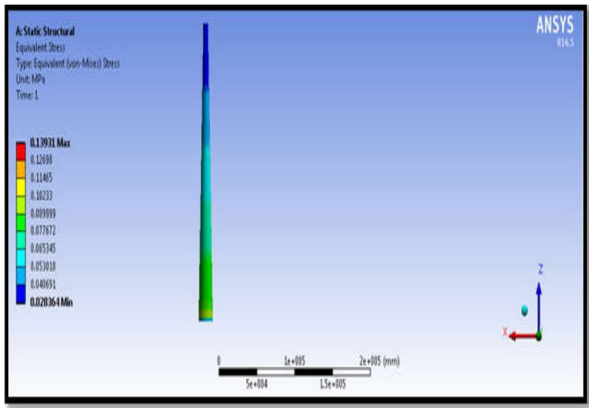




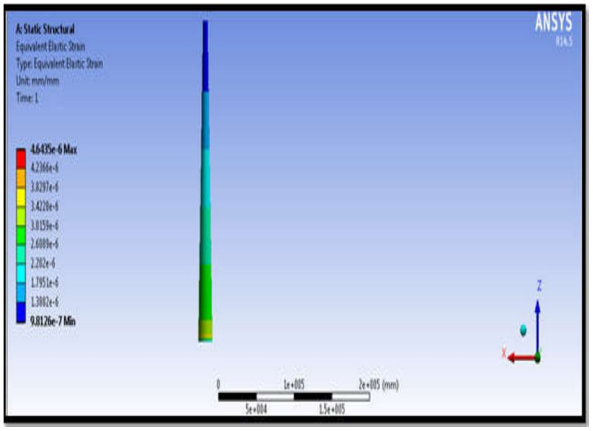
B. Deformation



C. Stress



D. Strain

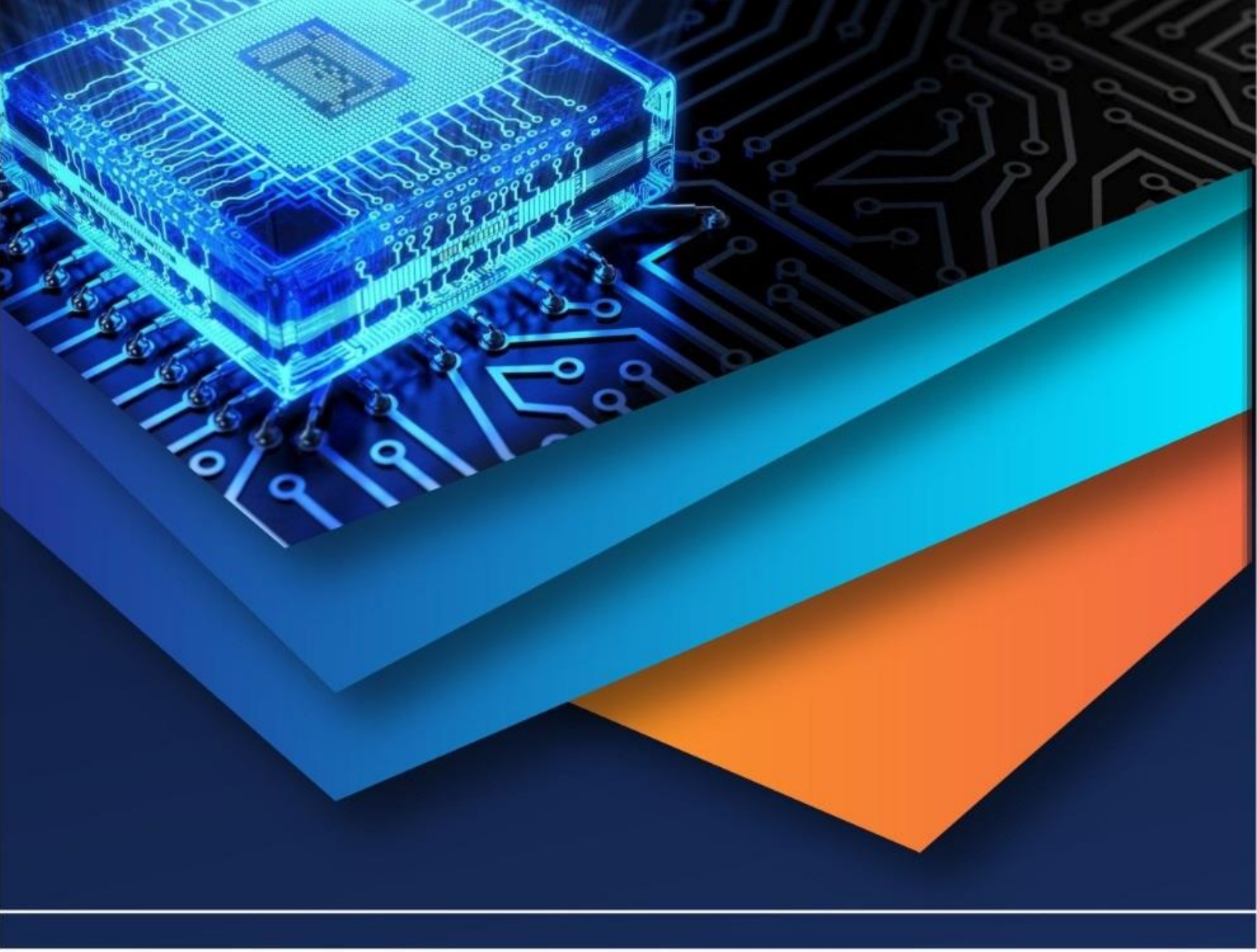


V. CONCLUSION

3D model of the chimney is done in pro/engineer and paired field analysis is accomplished at the chimney in ANSYS. A simplified model of chimneys with numerous thicknesses like 10mm, 14mm, 18mm, and 22mm have been modeled. With the aid of staring at the thermal analysis the warmth flux cost is greater for unique version of chimney and linear layer thermal evaluation the heat flux cost is more for 10mm thickness of chimney version. While we evaluate the thermal evaluation and linear layer thermal evaluation the heat fluxes greater for linear layer thermal analysis of chimney. By way of staring at the static evaluation the deformation and stress values are less for 22mm thickness of the chimney and linear layer static evaluation the deformation and stress values are less for 22mm thickness of chimney model. Whilst we compare the static evaluation and linear layer static evaluation the stress values are less for linear layer static evaluation of chimney. So it is able to be concluding the 22 mm thickness of the chimney model is the high-quality version whilst we do linear layer thermal and static analysis.

REFERENCES

[1] S.N.Manohar,"Tall chimneys design and construction", TATA McGraw-Hill Publishing Company Limited-1985.
[2] Draft copy CED 38(7892): 2013 (third revision of IS 4998(part 1):1992), "Criteria for design of reinforced concrete chimneys", Bureau of Indian standards, New Delhi, 2013.
[3] Menon.D, Srinivasrao.P,"Estimation of along wind moments in RC chimneys", Engineering Structures, Vol. 19, No. 1, pp. 71–78,1997
[4] K.R.C. Reddy, O.R.Jaiswal, P.N.Godbole,"Wind and earthquake analysis of tall RC Chimney", International journal of earth science and engineering, Vol. 4, pp. 508- 511, 2011.
[5] B.Sivakondareddy, V.Rohini Padmavathi, Ch.Srikanth, "Study of wind load effects on tall RC Chimneys", International Journal of Advanced Engineering Technology, Vol. 3, Issue 2, pp. 92-97, 2012.
[6] K.R.C. Reddy, O.R. Jaiswal, P.N.Godbole, "Combined design moments of tall reinforced concrete chimneys", National conference on wind engineering, pp. 135-146, 2012.
[7] M.G. Shaikh, H.A.M.I. Khan,"Governing loads for design of a tall RCC chimney", Journal of mechanical and civil engineering (IOSRJMCE), pp. 12-19, 2009.
[8] IS 875(part 3): (1987),"Indian standard code of practice for criteria for design loads(other than earthquake) for buildings and structures", Bureau of Indian standards, New Delhi, Reaffirmed 1997.
[9] IS 1893(part 4):(2005),"Criteria for earthquake resistant design of structures", Bureau of Indian standards, New Delhi, 2005.
[10] K.Anil Pradeep, C.V. Sivaramaprasad, "Governing loads for design of a 100m RCC chimney", National conference on new trends in civil engineering, pp. 81-87, 2014.



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