COUPLED FIELD ANALYSIS OF A CHIMNEY USED IN CEMENT INDUSTRY

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ABSTRACT

Chimney is a structure of ventilation, in this using a flue gas such as boiler form the last component of the system used in maintaining the efficiency, draft etc.. and decreasing the atmospheric pollution. The Steel Chimneys are also the type of Chimney made up of steel plates to support at the foundation By Using the Steel Chimneys the flue gases are sent out side in an elevation of a ground, so that the gases do not pollute the atmosphere in the surrounding.

The hot gases occupy larger volume than before. The weight of gases per cubic meter becomes less. The requirements of the chimneys have to be carry out the vertical type and discharge, combustion done by gaseous products, the waste gases from chemicals, and the polluted exhaust air to the atmosphere from an industry.

In this thesis, the wind load and dead load are taken as the considerations to design the chimney. The chimney is designed by using the procedures of Bureau of Indian Standards (BIS) design codes.

The cantilever annular cross section beam is taken under consideration for the design with the chimney. The software used to design the chimney in 3D model is Pro/Engineer and for the analysis of coupled field for the chimney is done in ANSYS. By using these, the Chimneys were modeled and made simple with distinct thickness like 10mm, 14mm,18mm, and 22mm.

Keywords

Chimney, Flue Gases,draft.

I. Introduction

Chimneys or stacks are vital industrial systems for emission of poisonous gases to the subsequent elevation such the gases don't contaminate near atmosphere. These structures are tall, narrow and customarily with round go-sections. Completely different production substances, like concrete, metal or masonry, are gained't to build chimneys. Steel chimneys are perfectly suited to technique work anyplace a short warmness-up amount and occasional thermal functionality are wished. Also, metal chimneys are low-priced for peak as much as 45m. Fig. One suggests a photograph of impartial metallic chimneys situated in associate diploma constructing complex.

There are several requirements available for coming up with self-assisting industrial metal chimneys: Indian every day IS 6533: 1989 (element-1 and part-2), requirements of worldwide Committee on business Chimneys CICIND 1999 (rev 1), and so on. Pure arithmetic of a self-supporting metallic chimney plays a essential position in its structural conduct below lateral dynamic loading. This is regularly due to natural mathematics is mostly answerable for the stiffness parameters of the chimney. However, the essential geometrical parameters of the metal chimney (e.g., overall height, diameter at exit, etc.) are related to the corresponding environmental Conditions. On prime of that style code (IS-6533: 1989 half 2) imposes many criteria on the pure mathematics of steel chimneys to confirm a desired failure mode. 2 vital IS-6533: 1989

fig:1.1 chimney diagram

II. Literature Review

1. Menon and Rao(1997) critiques the code measures to estimate the throughout wind reaction of ferroconcrete chimney. In this paper, the problems inside the coal evaluation of throughout wind moments and cargo problem provisions ar examined through reliableness technique. This paper mainly

suggests that it's critical to style at sure situations for the across wind loading [3].

2. K.R.C. Reddy, O.R. Jaiswal and P.N. God bole (2011) discusses concerning wind and earthquake analysis of tall Ferro concrete chimney. Throughout this paper 2 Ferro concrete chimneys ar analysed for wind and earth quake loads. Earth quake evaluation is completed as according to IS 1893 (component four): 2005 and wind evaluation is finished as in step with IS 4998 (element 1): 1992. The combination of on & throughout wind many chimney is completed as in line with ACI 307-ninety-eight code. Eventually they computed the governing load for style of chimneys.

3. B. SivaKonda Reddy, C. Srikanth, V. RohiniPadmavathi (2012) discusses concerning wind load effects on tall Ferro concrete chimneys. During this paper they idea-about 275m Ferro concrete coated chimney. The examine of this paper is on &across wind effects in this RCC Chimney for I and VI wind zones of Republic of India. In the end they terminated that, forWind region –I throughout wind hundreds ar governing and for wind region-VI on wind masses ar governing rather than the across wind loads

III. Problem Description & Methodology

The objective of this project is to shape a 3-d model of the chimney and observe the thermal and static conduct of the chimney through gambling the finite part analysis. 3-D modeling software package (seasoned-Engineer) was used for coming up with definitely exclusive geometries (10mm, 12mm, 14mm, and 16mm thickness) and analysis software program bundle (ANSYS) changed into used for thermal and static analysis.

The technique observed within the task is as follows:

- Create a 3D version of the steam chimney mistreatment consistent quantity software package deal pro-engineer.
- perform thermal evaluation and linear layer thermal analysis on the chimney for thermal masses, to are seeking out the temperature distribution and heat flux.
- perform static evaluation and linear layer static analysis on the chimney for thermal hundreds, to seek out the deformation, strain and pressure distribution.

A. Introduction to PRO/Engineer

Pro/ENGINEER, PTC's parametric, integrated 3D CAD/CAM/
CAE solution, is used by discrete manufacturers for mechanical engineering, design and manufacturing. Created by Dr. Samuel P. Geisberg in the mid-1980s, Pro/ENGINEER was the industry's first
successful parametric, 3D CAD modeling system. The parametric modeling approach uses parameters, dimensions, features and relationships to capture intended product behavior and create a recipe which enables design automation and the optimization of

B. Introduction to Finite Element Method

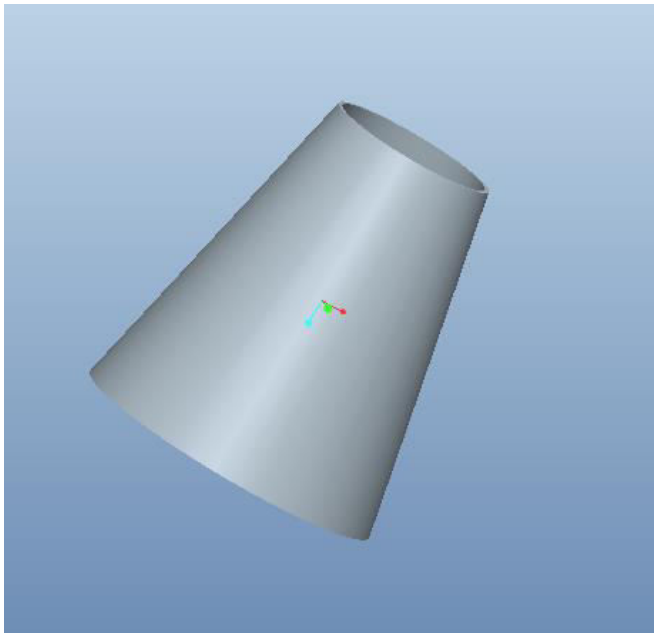
Finite Element Method (FEM) is also called as Finite Element
Analysis (FEA). Finite Element Method is a basic analysis technique for resolving and substituting complicated problems
by simpler ones, obtaining approximate solutions Finite element
method being a flexible tool is used in various industries to solve several practical engineering problems. In finite element
method it is feasible to generate the relative results. ANSYS is an

Engineering Simulation Software (computer aided Engineering).
Its tools cover Thermal, Static, Dynamic, and Fatigue finite element analysis along with other tools all designed to help with
the development of the product. The company was founded in 1970 by Dr. John A. Swanson as Swanson Analysis Systems, Inc. SASI. Its primary purpose was to develop and market finite
element analysis software for structural physics that could simulate
static (stationary), dynamic (moving) and heat transfer (thermal)
problems.

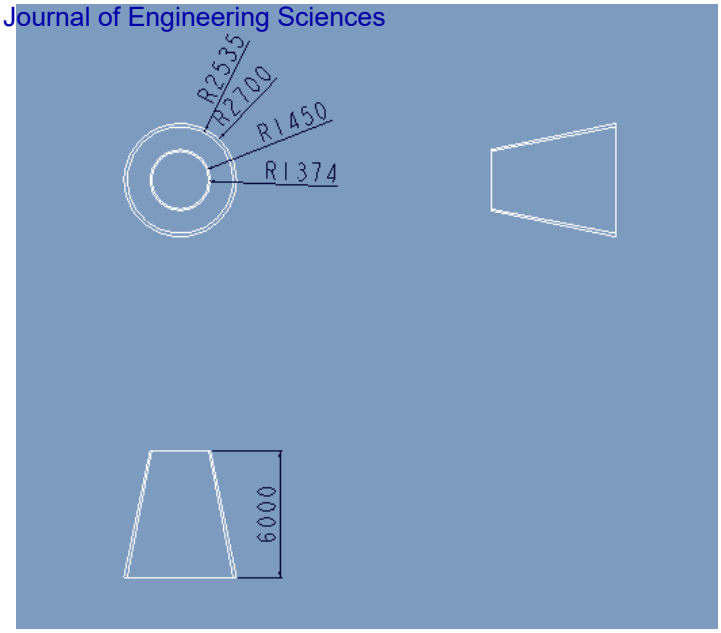
IV. Modelling and Analysis

A. Models of Narrow Plate Using Pro-e

The vertical narrow plate is modeled using the given specifications and design formula from data book. The isometric view of vertical

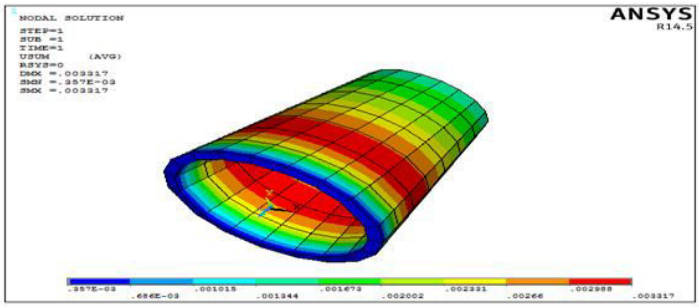


3D Model of chimney

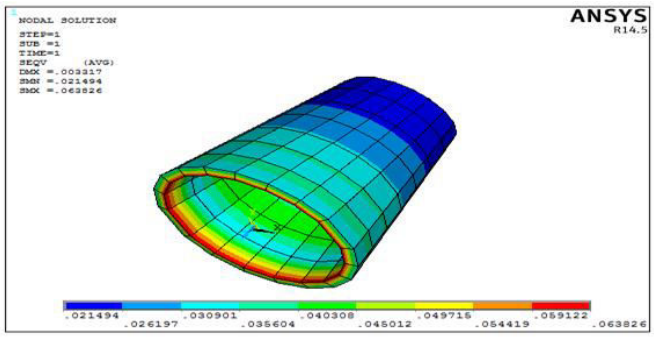


2D model of chimney

Chimney thickness 18mm: Deformation

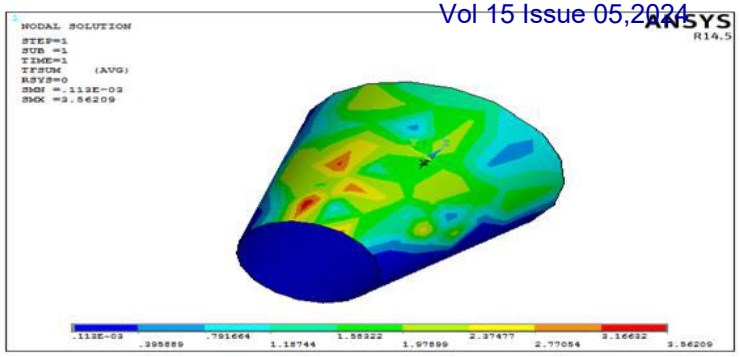


Stress:

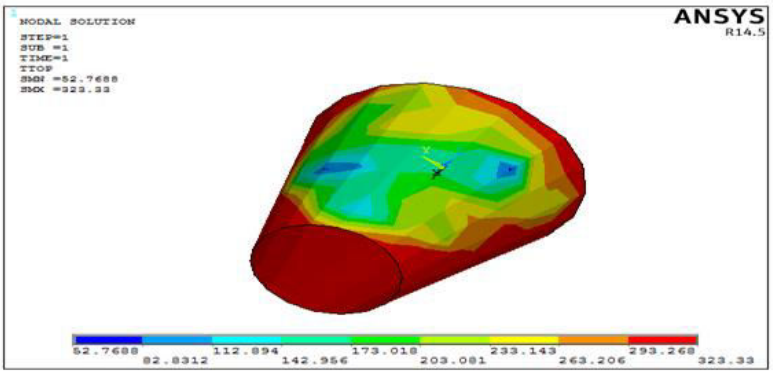


C.Thermal Analysis of chimney wth insulation
Chimney thickness 18mm

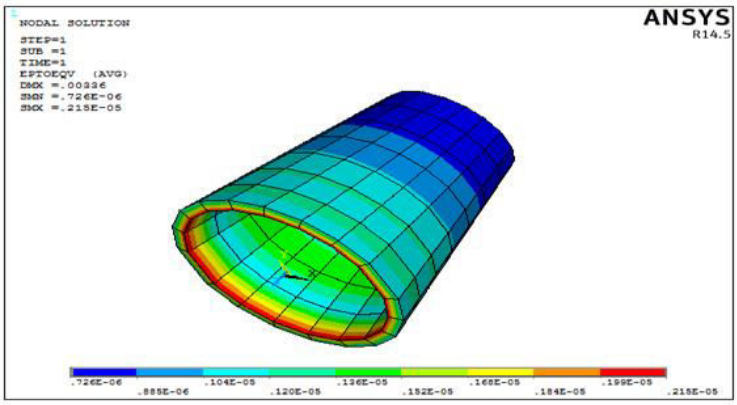
Heat flux:



Temperature:



Strain:



V. Results and Discussion

Result tables

5.1 Thermal Analysis Result Table

Chimney thickness (mm)	Temperature (K)		Heat flux (W/mm^2)
	Min	max	
Original model	303.07	473	0.15537
10	303.02	473	0.14822
14	303.06	473	0.143
18	303.08	473	0.137
22	303.05	473	0.1290

Table 1: Thermal Analysis Results

5.2 Static Analysis Result Table

Thickness (mm)	Deformation (mm)	Stress (N/mm^2)	Strain
original	0.0081522	0.14227	4.7426 e-6

10	0.0078515	0.1537	5.126 e-6
14	0.0077429	0.13701	4.5672 e-6
18	0.0075227	0.13347	4.49 e-6
22	0.00721	0.12788	4.269 e-6

Table 2: Static analysis results

5.3 LINEAR LAYER THERMAL ANALYSIS

Chimney thickness (mm)	Temperature (K)	Heat flux (W/mm^2)
Original model	325	1.980
10	324.319	3.574
14	323.818	3.564
18	323.33	3.562
22	322.865	1.971

Table 3: Linear Layer Thermal Analysis Results

5.4 LINEAR LAYER STATIC ANALYSIS

Thickness (mm)	Deformation (mm)	Stress (N/mm^2)	Strain
original	0.0025909	0.067132	0.224e-5
10	0.003404	0.065302	0.215e-5
14	0.00226	0.064556	0.214e-5
18	0.062317	0.063826	0.213e-5
22	0.002275	0.063111	0.210e-5

Table 4: Linear Layer Static Analysis Results

VI. Conclusion And Referrence:

3-d version of the chimney is completed in pro/Engineer and coupled discipline analysis is carried out at the chimney in ANSYS. A simplified model of chimneys with various thicknesses like 10mm, 14mm, 18mm, and 22mm had been modeled.

By means of staring at the thermal evaluation the warmth flux cost is more for original version of chimney and linear layer thermal evaluation the heat flux value is more for 10mm thickness of chimney model. Whilst we examine the thermal evaluation and linear layer thermal evaluation the heat flux greater for linear layer thermal evaluation of chimney.

By staring at the static evaluation the deformation and strain values are less for 22mm thickness of the chimney and linear layer static analysis the deformation and stress values are less for 22mm thickness of chimney model. When we compare the static evaluation and linear layer static analysis the pressure values are less for linear layer static evaluation of chimney.

So it could be conclude the 22 mm thickness of the chimney version is the high-quality version while we do linear layer thermal and static analysis.

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