

Application of STAAD in ESP Structure Design

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Abstract: China is a big country which manufactures and uses the ESP. For the ESP technology, years ago we import and pattern, now we have our own technology, also, the technique better and better. As the progress of science and technology, the design technology of ESP improved ceaseless. This article introduces the steel design software—STAAD with example, the application of the STAAD optimized the ESP's structure; reduce the consumption of metals required.

Keywords: electrostatic precipitator, steel structure, STAAD

1 INTRODUCTION

In the thirties last century, China imported electrostatic precipitator for the first time, times go to the sixties last century, Chinese began study the ESP; and came to seventies, Chinese had their own design of ESP basis on the mode. China imported several kinds the newest ESP technique again in eighties. In the end of last century, they had almost all kinds of ESP, China became a really big country not only it's own technique, but also the quantity of ESP which in use. In this significant progress process, the computer technology play a very important role, for example, Fluent used in CFD to model gas distribution, SCILAB using in emulation ESP, AUTOCAD and PROE using in engineering drawing and three dimensions model, STAAD and ANSYS integrate software in ESP design, all of this gave a great push to the ESP technique improvement. STAAD is professional steel structure design software, it is very specific, and easy to use, it built-in several countries steel structure specifications, and was favorite by engineers. This article introduces the application of STAAD in ESP structure design.

2 BRIEF INTRODUCTION OF STAAD

STAAD (Structural Analysis And Design) is a patent program which shared by Research Engineers International in California America. STAAD features a state-of-the-art user interface, visualization tools, powerful analysis and design engines with advanced finite element and dynamic analysis capabilities. From model generation, analysis and design to visualization and result verification, STAAD is the professional's choice for steel. Categorized load into specific load group types like dead, wind, live, seismic, snow, user-defined, etc. Automatically generate load combinations based on standard loading codes such as ASCE, ACI, LRFD, BOCA, IBC, UBC, GB, etc. Automatic wind load generator for complex inclined surfaces, irregular panels and multiple levels also taking into consideration user-defined panels.

STAAD's User Interface is the industry standard. Complex models can be quickly and easily generated through powerful graphics, text and spreadsheet interfaces that

provide true interactive model generation, editing, and analysis. STAAD easily generates comprehensive custom reports for anagement, architects, owners, etc. The STAAD Structure Wizard contains a library of trusses and frames. Use the Structure Wizard to quickly generate models by specifying height, width, breadth and number of bays in each direction. Reports contain only the information you want, where you want it. Add your own logo as well as graphical input and output results. Export all data to *Microsoft Word* or *Microsoft Excel*.

3 STAAD'S TYPICAL PROCESS

STAAD is a intelligent software for steel structure design, the main process is model generation, loading, analysis, criterion check, drawing, repeat design and optimize, then get the safety, reliable, reasonable and economy steel structure. All the data of model and analysis stored in a text file with suffix of .STD, this file can be changed by GUI or Editor. STAAD engine analysis STD, the result was stored in the file suffix of like ANL, BMD, TMH, etc.

4 THE USEFUL IN ESP'S DESIGN

ESP consist of support, inlet, outlet, casing, hopper and internals, In order to show the main process and the advantages of STAAD briefly, the following is a example which use STAAD to design a LEK-type ESP for 300MW steam generator, the software version is STAAD.Pro 2005:

• Model Generation

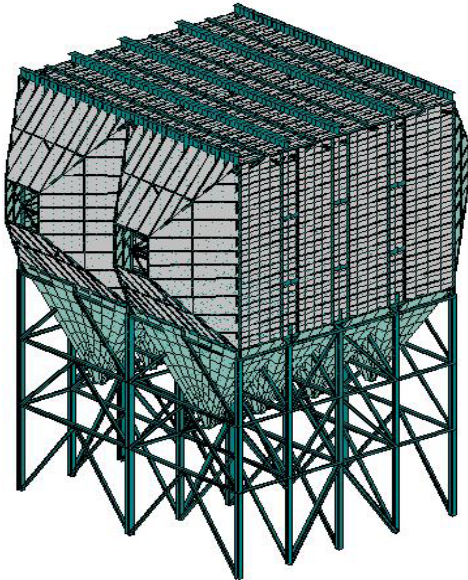
Use GUI or Editor making a text file named ESP.std as follows:

```
STAAD SPACE
START JOB INFORMATION
ENGINEER DATE 09-Feb-08
END JOB INFORMATION
INPUT WIDTH 79
UNIT METER KN
JOINT COORDINATES
...
MEMBER INCIDENCES
```

```

...
DEFINE MATERIAL START
ISOTROPIC STEEL
E 2.05e+008
POISSON 0.3
DENSITY 76.8195
ALPHA 1.2e-005
DAMP 0.03
END DEFINE MATERIAL
MEMBER PROPERTY CHINESE
...
The model as follows:

```



- **Loading**

```

LOAD 1 LOADTYPE Dead TITLE DEAD LOAD
JOINT LOAD
...

```

- **Check and Calculate**

```

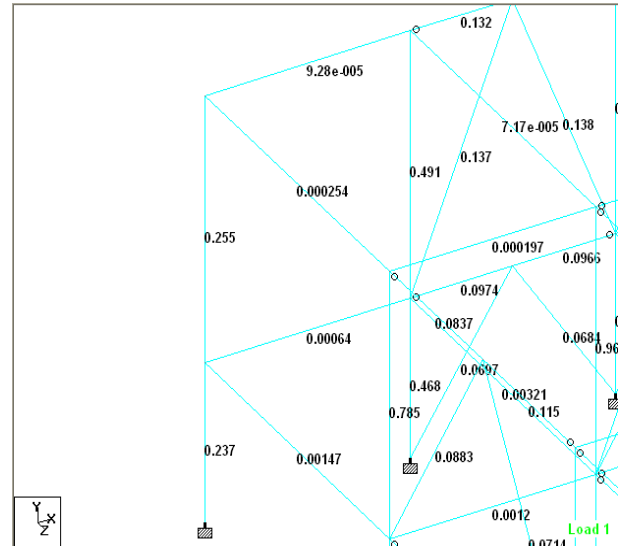
PERFORM ANALYSIS PRINT STATICS CHECK
PARAMETER
CODE AISC
FYLD 235000 ALL
PARAMETER
CODE AISC
CHECK CODE ALL
STEEL TAKE OFF ALL
PARAMETER
CODE AISC
FINISH

```

- **Output and Post Processing**

In the analysis process, STAAD will set up a file, include the information such as if the analysis ended normally or not, the order of model generation, loading, support reaction force, max displacement, if the every parts pass or not, and the total weight of all the materials, it is clear at a glance. The follow

picture is the on-screen result of ESP support:



The powerful graphics based facilities provide on-screen result verification and customized report generation. User friendly navigation and organization of data helps you get the information you need with a few simple clicks. Point and click on a member to obtain all the information on its Geometry, Cross-sectional properties, Forces, Moments, Displacements, etc. Even design information such as Allowable Stresses, Governing Code Criteria, Reinforcement layout, are available. Sort and Search based on required criteria to create customized reports. Arrange and rank the data based on Forces, Moments, Displacements, Stresses, etc., in ascending or descending order. Customize reports to include only the information you want, where you want it, including your company logo.

It is very useful that the displacement can be make into cartoon, so user can find the disadvantage of the parts, also it very easy to know if the parts are pass or not, if not pass, it will show you how much the parts exceed the allowable stresses in a ratio.

5 SUMMARY

All of the parts of ESP can be modeled as a whole, then to analysis in STAAD, so it can be conclude very precise stress of every parts in any loading condition, it's very useful to optimize, decrease the steel consumption and increase security, meanwhile in the condition of "whole type" model, STAAD can conclude the cycle of self-oscillation, analysis the affection and force transmit of every part, also it can analysis the affection of loading distribution. In a word, STAAD bring you more efficiency in ESP design.

REFERENCES

1. Technical Handbook REI Engineering Software Co. Ltd.
2. LEK ESP Design criterion Wuhan Kaidi Blue Sky Science & Technology Co., Ltd.