Two Unique Courses - Structural and Pipe Modeling

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Abstract

The University of Houston - Downtown, Department of Engineering Technology offers unique four year, ABET accredited degrees in Process Piping Design and Structural Analysis and Design. Within these programs are two specialized engineering modeling courses.

One course is "Piping Models". Students in this course use industry standard software to create 3D models of process plant and piping systems. The other course is "3D Modeling, Rendering and Animation". In this course, students create models of facilities related to their area of study; for example refineries or off-shore drilling platforms.

This paper presents examples of the work produced in each of these unique courses.

Introduction

Houston, Texas is known as "the oil capital of the world". It is home to dozens of refineries, petrochemical plants and oil and gas drilling operators. Locally, there are also hundreds of engineering, design and construction firms as well as numerous fabrication shops. These businesses make up and support the oil industry.

The oil industry has an ongoing need for employees trained in relevant technical areas. The University of Houston - Downtown, within its Engineering Technology Department has programs designed to fill this need.

Two such degrees are Process and Piping Design and Structural Analysis and Design. These are four year, Bachelor of Science degree plans that are accredited by TAC of ABET. The Engineering Technology Department offers two courses in the field of

engineering modeling which support these specialized degrees. They are called "Piping Models" and "3D Modeling, Rendering and Animation".

Piping Models

Piping Models (ET 4301) is a senior level, required course in the Process Piping Design degree plan. Students begin this course with prerequisite basics in 2D AutoCAD and MicroStation. The software that forms the primary basis for the pipe modeling course, and which will be described in more detail shortly, is MicroStation based. For this reason, the Piping Models course begins with an overview of MicroStation 3D capabilities and techniques. The students are assigned separate portions of a complex, 3D piping system, to be modeled using basic MicroStation techniques. The individual sections are then combined into an overall, unified model. Combining separately modeled piping into an integrated system quickly reveals the importance of direction and position in space.

Figure 1 is an integrated MicroStation model, which was formed by the combination of seven separate pipe models. At this point in the process, only the pipe, elbows and other cylindrically based entities have been included. Valves, pumps and other equipment have not been included. Even without any details about the specific plant, it is readily apparent which pipes are not properly located or oriented.
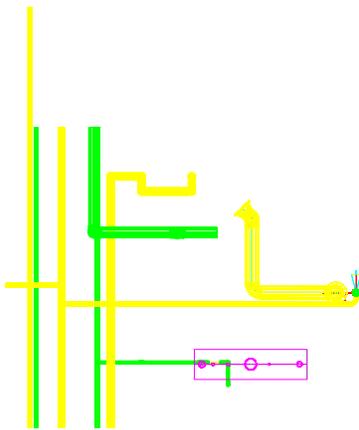
Figure 1

The software that is primarily used in the Piping Modeling course is PDS, which is MicroStation based. Intergraph Plant Design System (PDS)™ software is widely used in industry in the design of chemical/petrochemical facilities and also in the design of offshore platforms. PDS is a high-end software package that would probably not be available to our program were it not for industrial participation, implemented by means of

a collaboration with SPED (Society of Piping Engineers and Designers). Figure 2 is an example of a process plant and piping model created using PDS software.
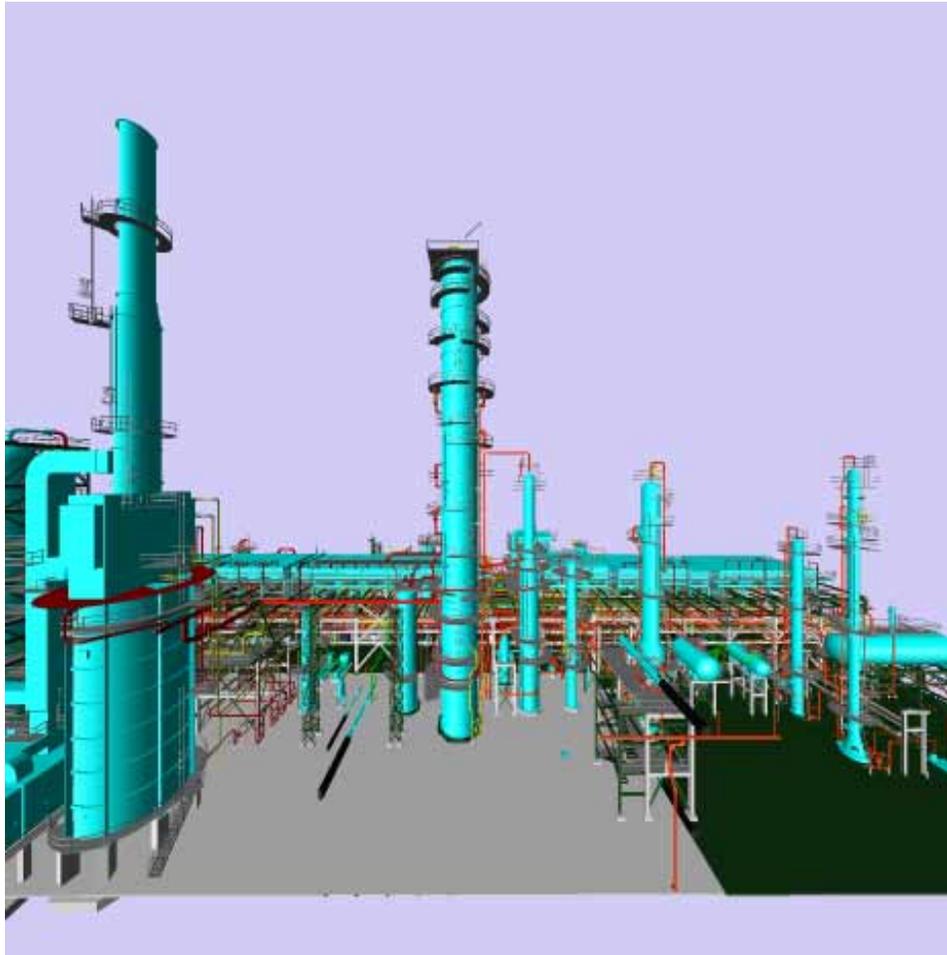
Figure 2

3D Modeling, Rendering and Animation

 ET 3325 presents the use of AutoCAD 2000, MicroStation SE and especially 3D Studio Max to create complete models of a wide variety of facilities and structures. These techniques are used for all types of commercial, industrial and architectural presentations.

Students are expected to develop a model of a typical industrial facility, including a process unit in a petrochemical facility, an offshore platform, and miscellaneous commercial and municipal buildings such as schools and libraries. The students are

prepared for the advanced technologies in analysis of three-dimensional structural, piping and electrical models.

Figure 3 is an extremely complex model of an offshore platform created by student Lamar Neale. It is indicative of the degree of sophistication in 3D modeling that our students may achieve.

Figure 3

Conclusions

Sophisticated software may be utilized in academic coursework to teach students to create models directly applicable to specific disciplines. Students can achieve a degree of competence in the use of these industry standard software packages, which will allow them to be immediately productive on the jobsite.

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