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ESIM-FSS2

Full Size Snubbing Simulation Training System

Technical Specification

1. Introduction

Full size snubbing simulation training system is developed by Southwest Petroleum University and Chengdu Esimtech Petroleum Equipment Simulation Technology Exploitation Co. Ltd. it is an advanced system with completed functions which can satisfy the training requirements of oilfield companies.

Full size snubbing simulation training system is developed by combining petroleum engineering, computer technology, and virtual reality technologies. It can simulate the operations such as running and pulling tubing and other tools with pressure, and can also present the operation and motion of key tools in snubbing operation. It can be used to training new workers, crew leader, operation supervisor, etc. Through the training provided by this system, students can master the basic methods of snubbing driller operation and the technological process of snubbing operation.

The system adopts quantity of mathematical models to simulate various parameters and physical relationship between them in snubbing operation, such as balance point, pressure, rate, etc. to reach the actual effect of real snubbing operation. Parameters can be set freely, such as bore frame, make up of string, formation parameter etc. which makes the training more targeted. The system can also simulate common working condition in snubbing operation and underground tools. Real time 3D animation can be displayed through 4K high definition display system. Combined with vivid sound effect, the system makes up an immersive training environment.

Figure 1 Snubbing simulator training room overview

The system is composed of snubbing driller console, display system and accessory software. All control consoles of the system are like the real snubbing site. The panel layout, operation method and parameter display are the same as the real device. Hardware devices are made up by

industrial PLC, which ensures the reliability of the system. The system has low input cost and maintenance cost and no security risk.

2. System Component

① Full size snubbing operation console

Full size snubbing operation console is designed according to the real snubbing unit as prototype. Its panel is made of aluminum, and shell is made of steel. The controlling and display of snubbing driller console is the same as the real console.

Meters on snubbing simulation console are jack-pressure meter, snubbing pressure meter, balance pressure meter, upper ram pressure meter, lower ram pressure meter, annular pressure meter, slips pressure meter, etc.

Simulation handles on snubbing console are traveling slips handle, stationary slips handle, traveling heavy slips handle, stationary heavy slips handle, upper ram and lower ram handle, balance valve and bleed off valve handles, annular preventer handle, etc.

Jack-up working pressure can be adjusted to set working pressure of jack-up. Brake valve pressure can be adjusted to control speed of jack-up.

Closing pressures of annular, upper ran and lower ram can be adjusted.

Figure 2 Snubbing Hardware

② Snubbing simulator computer

CPU: i7 or the same; Graphic card: RTX 2070 Super or the same; Memory: 16G; Hard disk: SSD 240G.

③ Printer

Functioning as networking, double-side and color printing, scaning and copying.

④ Sound effect system

Including amplifier, sound mixer, wireless microphone receiver, wireless microphone set (hand microphone, waist mounted transmitter, conference microphone), speakers.

⑤ Displaying system

70-inch super high definition screen. Resolution: 4K (3840*2160). HDMI video input interface.

⑥ Esimtech full size snubbing simulator platform software

Mainly used for the interface setting of the whole scenerio of the snubbing operation and the operation platform.

⑦ Esimtech full size snubbing simulator technology software

The software is mainly used to acquire and analyze the data of hardware and graphic software. It provides parameters setting and adjusting, such as casing pressure, size of jack-up cylinder, outside diameter of tubing, wall thickness of tubing, steel level of tubing, tubing length, fluid density in well, fluid level in well, etc. safety BOP stack at wellhead and downhole tools assembly can be chose and set, such as centerpart selecting, safety BOP stack selecting, tool asssembly, etc. and realize the simulation of snubbing operation. The software provides English and Chinese language which can be shifted at any time. And the measurement unit has also options of Engish and metric. It can also simulate the onsite sound of jack-up, slips, BOP, etc. The software also provides hardware diagnosic function, student information managing function, as well as automatic scoring function.

⑧ Esimtech full size snubbing simulator graphic software

The software displays the whole scenario, snubbing operation platform and presents the whole operation procedure in the form of 3D animation.

3. System Function

3.1 Function and Feature

1. The simulation system takes real snubbing equipment as prototype. The handle levers, meters and switches on the console are the same as those on real rig.

2. Parameter display: system oil pressure, BOP ram pressure, balance/ bleed valve, casing pressure, well depth, tubing shoe location, lifting board height, etc.

3. It has flexible parameter setting function. Instructor can set various parameters freely, such as well depth, casing pressure, tubing parameter, etc. Instructor can customize parameters based on real well condition and real equipment condition, which can make the training more authentic, as if training on a real well.

4. 3D animation provides the real site visualization. The animation can display the snubbing rig floor scene, BOP motion and working theories. The system can display different scenes through shifting and splitting screen display, such as driller console perspective, BOP perspective, slips perspective, etc.

5. The system has vivid sound effect. It can simulate various noises on real site. The start and stop of sound comply with students' operation, working condition and graphics.

6. The system can score students' operation automatically. It can provide scores and point deducting reasons according to students' operation procedure and skill.

7. It has completed students managing function. It can manage students' information, operation project, scores, etc.

3.2 Training Project

A. Calculating balance point and unsupported length

B. Running and pulling tubing:

(1) Pulling string above high-pressure balance point
(2) Pulling string below high-pressure balance point
(3) Pulling string above low-pressure balance point
(4) Pulling string below low-pressure balance point
(5) Running string above high-pressure balance point
(6) Running string below high-pressure balance point
(7) Running string above low-pressure balance point
(8) Running string below low-pressure balance point
(9) Running and pulling string above 21 MPa
(10) Running and pulling string in barren hole

C. Running and pulling fittings:

(1) Pulling tubing hanger
(2) Setting tubing hanger
(3) Running and pulling packer

4. Technical Parameters and Operational Environment

4.1 Technical Parameters

(1) Power supply: 110~220V/50~60Hz AC

(2) Power consumption: <6000W

4.2 Operational Environment

(1) Area: >=5*4m

(2) Separate equipment power supply from lighting

(3)Working temperature: 0℃～30℃

(4) Relative humidity: <90%

5. Program Interfaces

Figure 3 Software interfaces

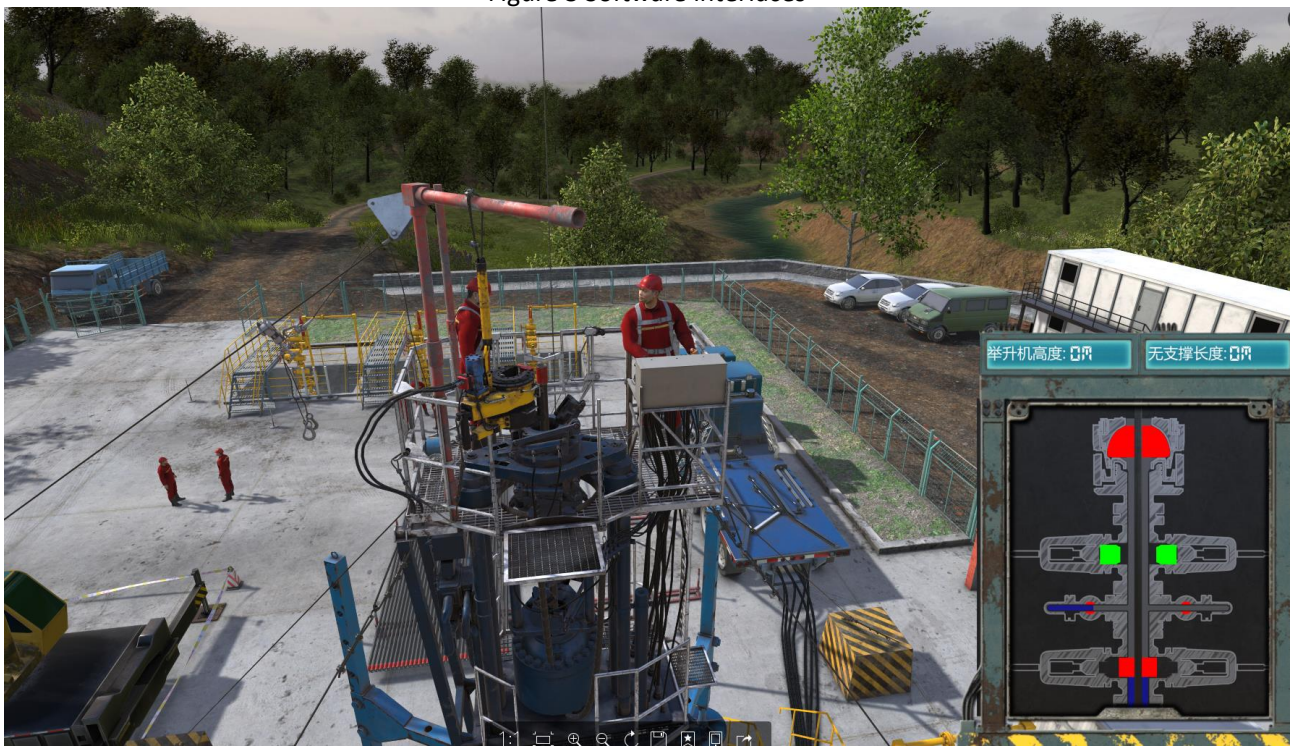

Figure 4 Graphics program running interfaces