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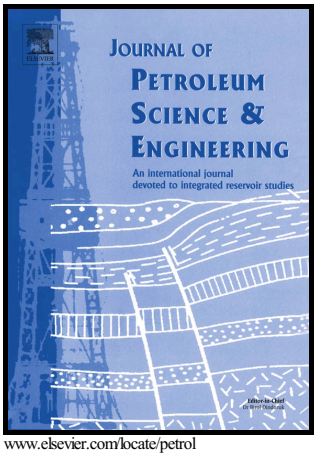

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Research advances and debates on tubular mechanics in oil and gas wells

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Abstract

Tubular strings in oil and gas wells are the backbone and central nervous system of oil and gas drilling and production operations. Tubular mechanics in oil and gas wells is the most important applied fundamental science in petroleum and gas engineering. This paper first introduces monographs on tubular mechanics in oil and gas wells, as well as scholars engaged in investigating this field. Then the methods used in this research are explored, and basic concepts are clarified. The paper then focuses on research progress and debates about the fundamental principles of tubular mechanics in oil and gas wells, the motion states of tubular strings in oil and gas wells, the fundamental equations for dynamic analysis of the rod and pipe string in oil and gas wells, the stability of the rod and pipe string in oil and gas wells, the steady-state tension and torque in the rod and pipe strings in oil and gas wells, three-dimensional mechanical analysis of the bottom hole assembly, the drill string dynamics, casing string mechanical analysis, testing string mechanical analysis, fracturing/water injection/steam injection tubing string mechanical analysis, diagnosis and parameter optimization of the sucker rod pump system as well as energy savings, vibration of the gas production tubing string, impact vibration of the string, expansion screen pipe/casing mechanical analysis, riser string and deepwater pipeline mechanical analysis, vibration wave signal transmission in the string, wear and corrosion as well as erosion of the string, and residual strength and fatigue strength forecasts, connections mechanical analysis, strength design and verification of the string. In the end, the paper discusses key future research directions.

Key words: drill string; casing; tubing; pumping rod; riser; mechanics; vibration; advance; debate

1. Introduction

Tubular strings in oil and gas wells are the backbone and central nervous system of oil and gas drilling and production operations; without them there is no petroleum and gas industry. Tubular mechanics in oil and gas wells is the most important tertiary subject in petroleum and gas engineering. The primary research areas in tubular mechanics