Baker Hughes

JewelSuite Drilling Engineering

Integrated drilling modeling and simulation software

JewelSuite™ Drilling Engineering software is an integrated technical planning, modeling, and simulation environment for all drilling applications. It provides standard and advanced physics models for use in the office as well as in real time:

- Bottomhole assembly (BHA) and drillstring design
- Torque and drag analysis
- Drilling and tripping hydraulics
- Advanced drillstring and BHA mechanics

Accurate simulation of the drilling process is critical to reducing risks of losses, stuck pipe, nonproductive time (NPT), and other events, while enabling optimum and repeatable drilling and completion performance.

JewelSuite Drilling Engineering software provides a step change in efficiency for planning, execution, and improvement of directional drilling applications. The highly integrated, yet flexible workflow is focused on fast and reliable design of engineering solutions and on effective scenario analysis.

Powered by a comprehensive catalog of >6,600 drillpipes, collars, and BHA components drill strings are built quickly while eliminating data entry errors.

Well and log data in a large number of formats is easily integrated into the engineering model.

Built on a scalable, modern platform architecture, JewelSuite Drilling Engineering is fully real-time enabled, as a key input to advanced drilling monitoring and automation services.

The pre-job models are continuously updated with live data during job execution, replacing planning parameters with real measurements. This provides the most accurate, always current insights into actual downhole conditions during various stages of the well construction process.

The underlying algorithms are based on more than 30 years of Baker Hughes experience in hydraulics and mechanical drilling process simulation, often exceeding industry standards and proven through daily use around the globe.

Applications

- Physics-based simulations for directional drilling
- Horizontal wells
- Extended reach wells
- Complex offshore wells with challenging pressure profiles
- Exploration campaigns

Benefits

- Proactive risk management in job planning and during execution
- Assurance of wellbore integrity
- Optimum drilling performance
- Minimized NPT and invisible lost time (ILT)
- Fast, efficient engineering process through optimized usability
- Evergreen digital twin of the well construction process with seamless real-time refinement of the pre-job model

Specifications

Common features	
Software version	JewelSuite Drilling Engineering 2020.4.709
Platform	Built on the Baker Hughes **JewelEarth™ software development platform** for seamless cross-disciplinary workflow integration
Drillstring catalog	Comprehensive catalog of >6,600 Baker Hughes and API-standard drillstring components with all attributes necessary for deployment planning and simulation
Hydraulics	
Drilling hydraulics	• Equivalent circulating and static density (ECD, ESD) calculation, with and without cuttings influence • Pressure drop in drillstring and annulus, standpipe pressure • Flow split analysis • Fluid velocity required for hole cleaning; cuttings bed and rate of penetration (ROP) sensitivity analysis • Single and multiple flow rates simulation, including riser booster pumps; split-flow analysis • Bit hydraulics (jet impact force, hydraulic horsepower)
Swab and surge analysis	• Trip speed optimization for closed and open pipe, with and without pump flow • Simulation of pore, collapse, and fracture pressure along open hole, with pipe acceleration effect
Real-time simulations	• Continually updated ECD and hole cleaning prediction • Automatic optimum trip-speed profile prediction on every connection • Real-time parameter updates for depth, RPM, weight on bit (WOB), temperature, rheology data
Simulation logic	• Herschel-Bulkley, Robertson-Stiff, Bingham Plastic, Power Law, and Newtonian fluid rheology models • AI-enabled consideration of temperature and pressure effect on density and viscosity • Baker Hughes proprietary pressure drop and cuttings transport models, considering drillstring rotation and eccentricity for laminar and turbulent flow
Torque and drag	
Drillstring loads	• Equivalent stress, yield, and fatigue safety along the drillstring for single depth and entire section • Critical buckling loads and post-buckling behavior (sinusoidal, helical); drillstring stretch and twist
Surface loads	• Axial drillstring load and torque at surface; indicated hook load; friction factor sensitivity analysis
Real-time simulations	• Continually updated hook load and torque sensitivity analysis (broomstick chart)
Simulation logic	• Stiff string model, considering drill pipe tool joints and precise wellbore contacts • Analysis for drilling (rotating/ sliding), rotating off bottom, pick-up, slack-off, backreaming • Cased-hole and openhole friction factors, calibrated borehole tortuosity model
Advanced drillstring mechanics	
Advanced statics analysis	• Lateral, torsional, axial and angular drillstring deformation and lateral contact forces • Distributed bending loads along BHA for single depth and depth intervals • Build rate prediction • Natural and forced lateral vibration analysis including mode shapes, frequencies, and amplitudes
Simulation logic	• Proprietary finite element model optimized for drillstring and BHA analysis • Consideration of detailed string and wellbore geometry, steering force, and borehole contacts

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