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Creating an Open Source Drilling Community

Energy lives here™

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Outline

- Objective
- OSDC Start Up and Status
- The Steering Committee
- The Drilling Process
- Importance of Modeling in the Drilling Industry
- Issues with Current Modeling Efforts
- Benefits of Open Source
- Validation Process
- How to Join the Effort and Contribute

Objective

Form a coalition of industry and academic leaders to encourage the use of continuously improving world class models.

The key efforts have been to:

- set up a repository for source code, benchmarks, and documentation
- document good coding practices
- encourage SME review on the models and data submitted
- test, use and improve the code
- collect drilling data for validation and request data needed
- attract talent and
- mentor those getting started

Open Source Drilling Community Status

- 2018 Deep Drilling Colloquium Question

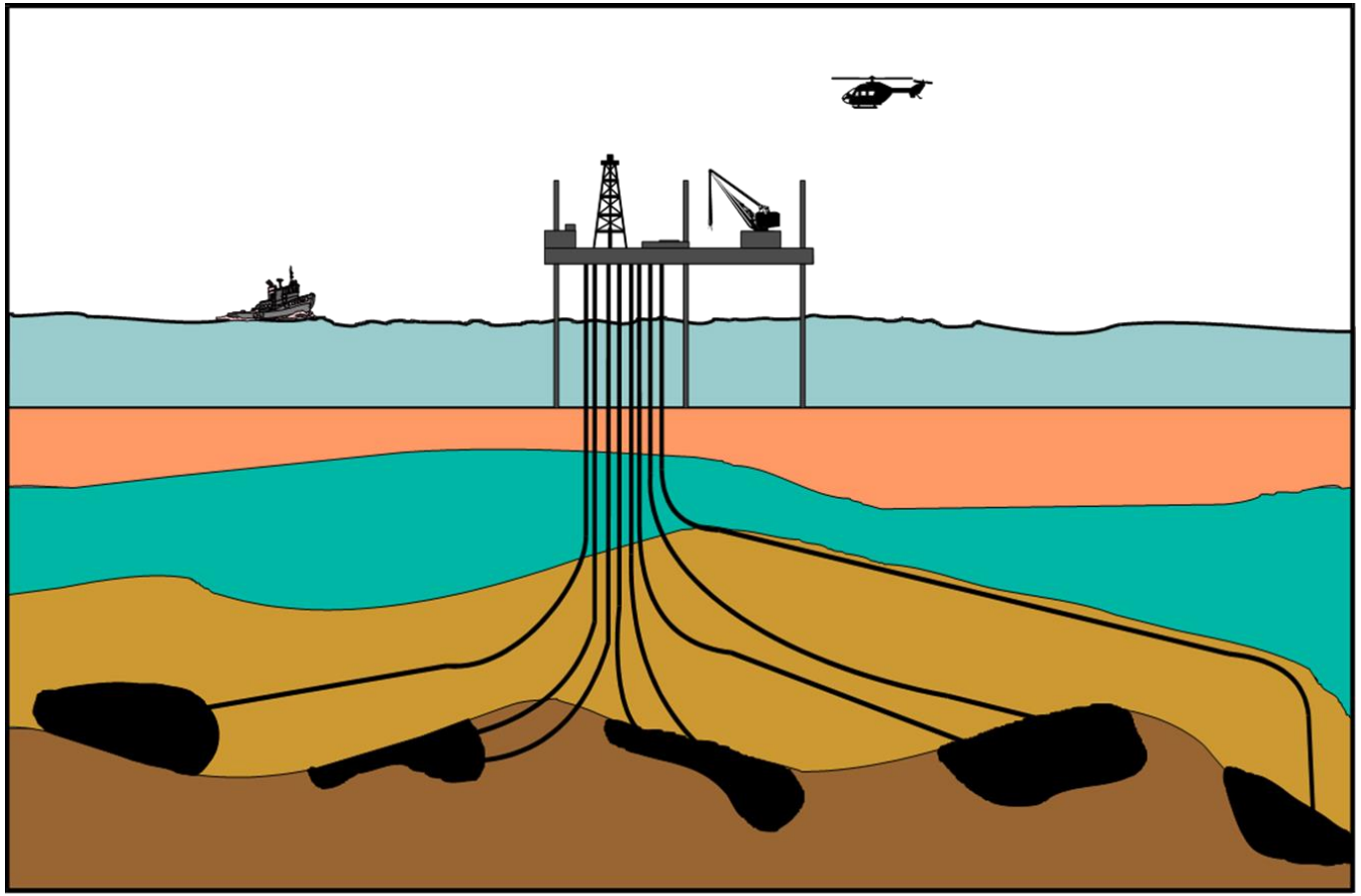
  Is it time to start using open source models to solve drill string dynamics issues?
- 2019 SPE 194082

  Creating Open Source Models, Test Cases, and Data for Oilfield Drilling Challenges
- 2020 - SPE DSATS Charters Open Source Sub Committee
- 2020 - Covid Delays
- 2021 - OSDC Biweekly Steering Committee Meetings
- 2021 - Soft Launch - September

The Steering Committee

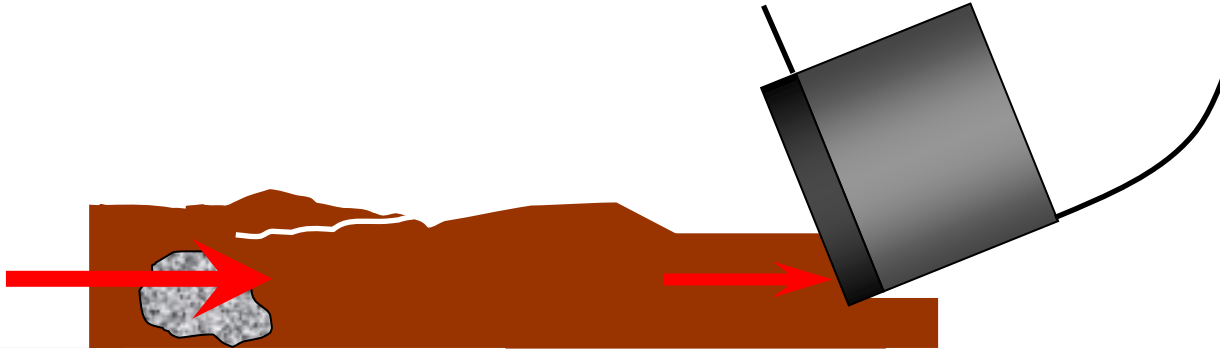
- ExxonMobil challenged the industry and gathered a coalition of experts to start this effort
- The University of Calgary is hosting the Web and GitHub sites
- Models submitted by the University of Calgary, Texas A&M, Scientific Drilling, NORCE, and ExxonMobil, with more coming
- MathWorks has helped convert ExxonMobil code to Simulink
  - Improved ease of use, interface, modularity,
  - Optimize execution speed and stability
  - Document how to set up and use the models

The Drilling Process



ExxonMobil

The Drilling Process

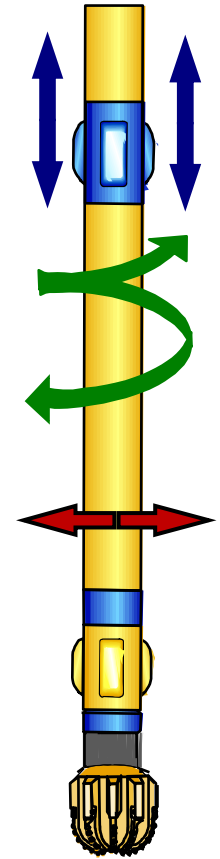


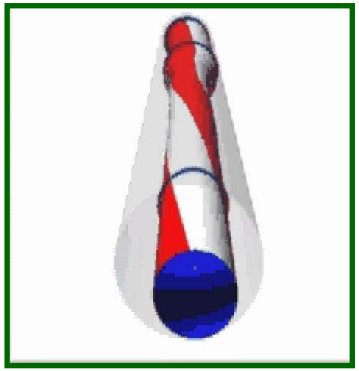
Load F_t Tangential to Edge

ExxonMobil

The Drilling Process

- Axial
  - Bit-Bounce
  - Auto Driller Instability
  - Heave
- Torsional
  - Low Frequency Torsional Oscillation
  - Stick-Slip
  - High Frequency Torsional Oscillation (HFTO)
- Lateral / Whirl
  - BHA Forward
  - BHA Reverse
  - Bit Forward
  - Bit Reverse





Reverse Whirl Spirograph

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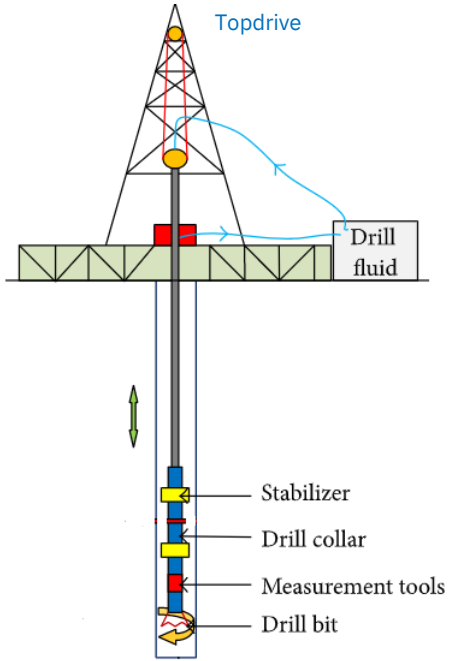
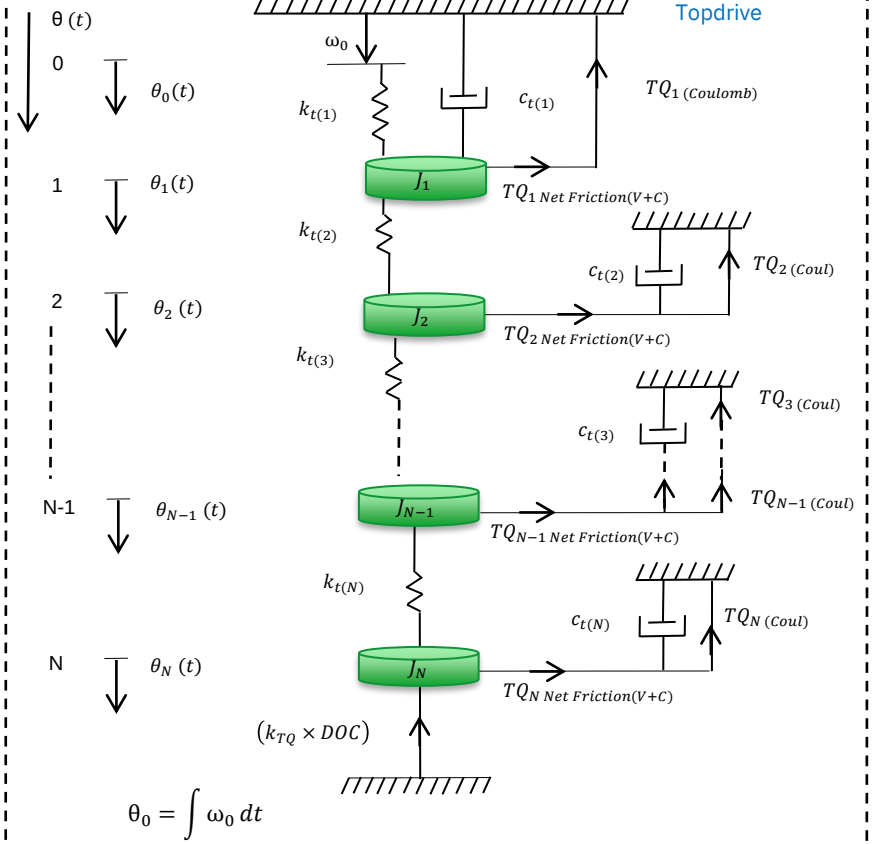
Graphics and Animations used with permission of Halliburton, Baker Hughes and Indonesia Drill Team

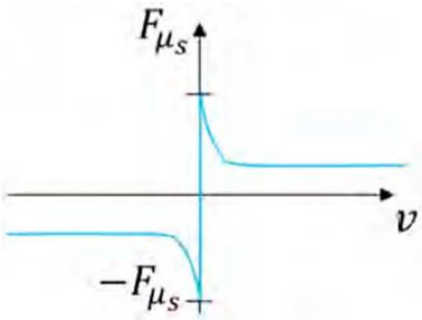
Importance of Modeling

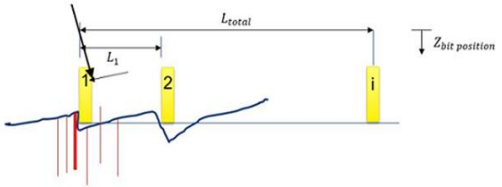


Guangjian Dong et. al. (2016)

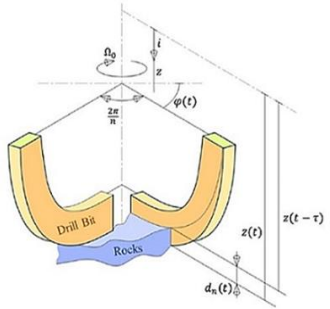


$$\theta_0 = \int \omega_0 \, dt$$





Current Rock-Surface Tracking Model



Ref: Detourney et. al. 2007

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Importance of Modeling

- Cost of Failure / Risks
- Limited Measurements
- Understanding vs Prediction (Feynman)
  - Modeling allows us to understand the system physics
  - New tools and procedures can be tested via simulation, potential for fewer rig trials
  - It should be inconceivable to put a new tool in the ground or new control system on a rig without fully testing the system for performance and stability

Issues with Current Modeling Efforts

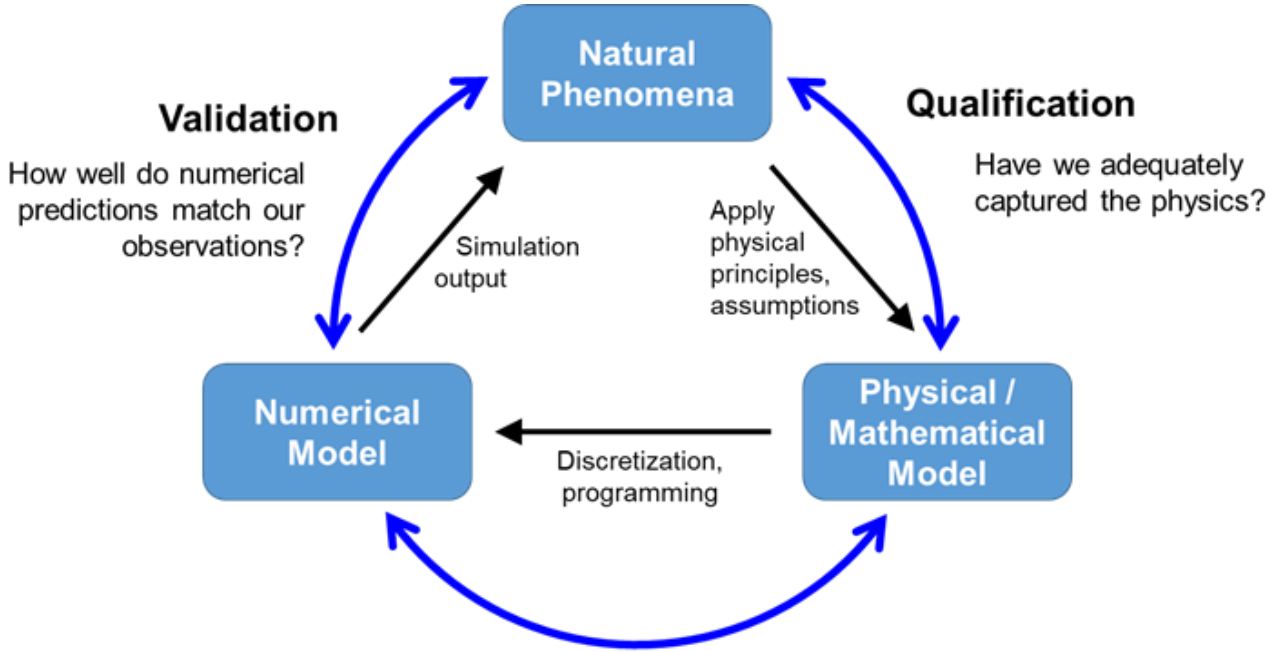
- Commercial Models – Often Opaque
- Academic Models – Often Single Use
- The Challenge of Incremental Improvements
- Publishing of JIP Models

- Improvements Needed
  - Verification – Math and Code Verification
  - Validation – Comparison to Case Studies

Benefits of Open Source

- Collaboration
- Transparency
- Less “Reinventing the Wheel”
- SMEs Create Better “Focused Models” – autodriller, bits, motors
- Model Benchmarking
- Integration, Integration, Integration
- Open Source Models and Proprietary Code

Validation Process



How to Join the Effort and Contribute

- To join this effort go to the Open Source Drilling Community
  - Add your contact information to the Mailing List / Contribute tab

- Sponsored by SPE DSATS Sub Committee
- University of Calgary coordinating Web and GitHub sites
- MIT Open Source License - All models, data, and test cases are freely available for academic and commercial use

How to Join the Effort and Contribute

Publish models, data, results through peer-reviewed literature

- Submit model to GitHub Site (internal)
- OSDC Steering Committee will expedite public release

Submit models, data, and documentation to OSDC

- Include your organization’s required Release of Information
- Submit model to the GitHub site (internal)
- OSDC Steering Committee set up review plan for public release

Contribute time, talent, funding to the effort

Questions