

# Accurate, faster hydraulics models for safer drilling for oil and gas

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Ph.D. candidate Mohammad Hossein Abbasi of the TU/e Department of Mathematics and Computer Science has developed numerical tools to support the safer, cheaper and more efficient drilling of deep wells for

exploitation of natural resources. His models are accurate enough for virtual drilling scenario testing and drilling automation, and speed up simulations up to 70 times.

Drilling of deep wells offers enormous value for global economies, for instance for the exploration of minerals, geothermal energy, oil and gas. However, the remaining reserves of these resources are increasingly found in difficult-to-access, unconventional places, and their exploitation needs to be balanced with [environmental concerns](#) and the high cost of drilling operations. The models Abbasi developed are a big step toward revolutionary advances in operational and environmental safety and cost-effectiveness of resource exploration.

## **Predicting the hydraulics at work when drilling a deep well**

The scientific objective of the research project is to develop a framework to model the hydraulics involved in the multiple phases of Managed Pressure Drilling (MPD) and to package the models in software directly usable in industry. To deliver fast results during drilling operations, it is critical to reduce the complexity of these models as much as possible. Abbasi's models uniquely combine high predictive capacity and low complexity, which makes them very interesting for use in both virtual drilling scenario testing and drilling automation.

## **Speeding up the simulations while retaining accuracy**

To lay the foundations for the industry tool, Abbasi and colleagues developed accurate and physically relevant mathematical models and many novel numerical techniques that are an improvement over the currently used numerical techniques. The new ones are much more computationally efficient and fast enough to be run in real-time

simulations, which makes them much less expensive to use.

Abbasi's techniques speed up the simulations up to 70 times while retaining 99% accuracy. With his methods, predicting MPD hydraulics can be done much faster than real time, which speeds up the optimization of well plans considerably. Moreover, [model](#)-based controllers can be efficiently tested on this fast platform, which is an accurate representative of the real [drilling](#) well. With these advances, the safety and cost-effectiveness of resource exploration in Europe and beyond can be increased massively.

**More information:** Modeling and order reduction for hydraulics simulation in managed pressure drilling. [research.tue.nl/en/publication...-simulation-in-managed](https://research.tue.nl/en/publication/...-simulation-in-managed)

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