JewelSuite – high definition modelling of the subsurface

Netherlands oil and gas software company JOA has developed a tool which, it claims, make it much easier to model the subsurface, because (unlike on traditional subsurface modelling tools) there is no need to try to make the grid blocks align with faults.

Most subsurface modelling techniques divide the subsurface up into a number of cells by aligning pillars with fault planes. This is known as pillar gridding and has been around now for some 10 years.

However on the JOA software, all of the pillars (vertical lines) can be absolutely vertical. No smoothing or simplifications of shape are required to be made to the model, to make it fit to a grid. The company claims that it is the most "accurate geological software tool available in the market."

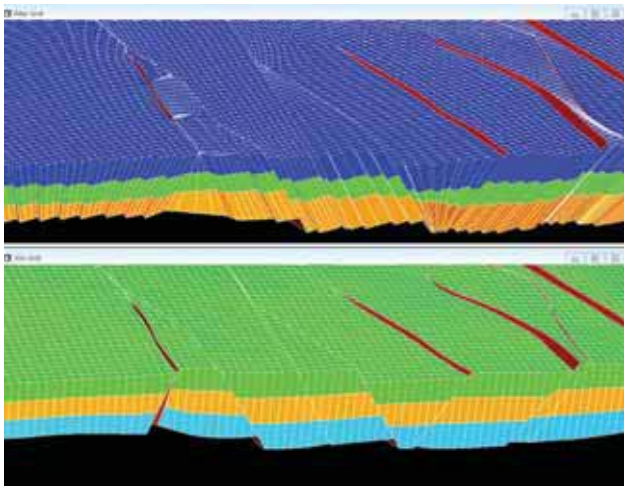

Figure 1 illustrates how the same data looks like with a traditional pillar grid program (above) and with the JOA software Jewel Suite (below).

With the JOA software, the grid is orthogonal - it doesn't matter if the fault or unconformity surfaces are complexly arranged. "The pillars always remain vertical in the Jewel Suite model – in effect it is like putting a cookie cutter though the sub surface," says Jonathan Jenkins from JOA.

On the JOA system, there is no need to fit whole cells around corners; this is different to most traditional gridding software, where users often change diagonal fault lines into stair steps to fit in cells. "This unnecessarily reduces the fidelity of the simulation model," he says.

Models can be built much more quickly with the JOA system, the company claims. In one case, "we took a model someone took 6 months to build in other software and rebuilt it in 5 days and we kept the faults geologically accurate," says Mr Jenkins.

The JOA models can also be updated much more easily. "If you decide a fault should be in a different place, you can update the model with a single operation," says Mr Jenkins.

Normal gridding software can be fine for relatively simple fields, but the JOA software should prove particularly useful in complex faults with many faults, Mr Jenkins says.

The JOA software is available at, the company promises, half the price of a similarly configured Petrel licence from Schlumberger.

The tool can be used on its own or easily integrated into other software such as SMT's Kingdom Suite. "It is completely scalable: we have built huge comprehensive models for some of the biggest oil and gas fields of the world," he says.

Problems with traditional gridding

Users of traditional pillar gridding techniques can have a lot of problems when trying to create grids around faults, as figure 2 illustrates.

When dealing with complex fault geometries, you can end up with squashed cells that are harmful to the stability of simulator calculations and require extensive manual clean-up.

"We are often surprised by the ingenuity and tenacity of modellers building rather complex models with frankly, inferior tools," he says. " It is a very tedious process however, and once you feel the power of an orthogonal grid and the integrated solutions around it, most never want to go back."

Often assumptions or fudges are made to try to make the pillars fit around the faults.

Sometimes, as a remedy, pillars are only lined up with one fault accepting that pil-

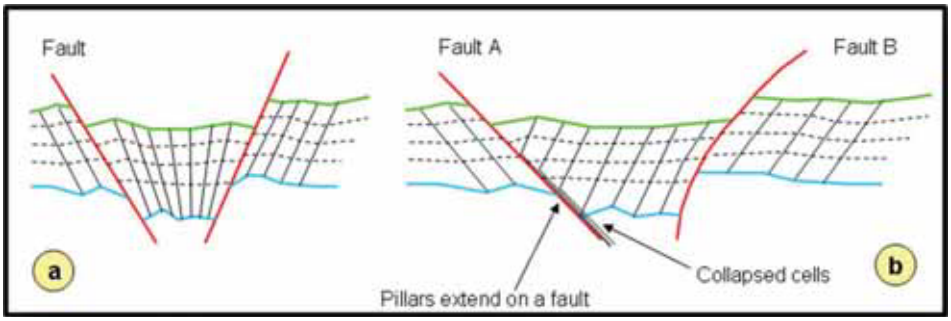

Figure 2 - modelling complex fault geometries can lead to squashed cells that need manual clean-up

lars are 'travelling" along the other fault plane - Fig 2. Example (b); this way one succeeds in capturing geometry in pillar grids but it becomes nearly impossible to calculate reliable flow properties between cells on either side of the fault.

These twin issues are responsible for too many sub surface having faults 'verticalised' – something done 20 years ago and nowadays unacceptable to modelling smaller and more complex reservoirs.

"Modellers are a clever bunch and to reduce months of mindless editing, they will sometimes not model the faults interpreted on seismic," says Mr Jenkins.

"The other trick is to create 'pancake' geocellular models. By making models really thin one can avoid geometry problems," he says.

"This approach barely covers single reservoir units," Mr Jenkins continues. "It ignores stacked reservoirs, deeper layers and the overburden. So what about flow of hydrocarbons or water between different reservoirs? Or what of the potential of modelling the full field? With so many approximations accuracy is lost or too roughly measured, this is unacceptable."

Connecting to simulators

Simplifying your finished grid model, so you can use it in reservoir simulators, is easily done, as figure 3 (below) indicates.

The JewelGrid can connect to a wide range of subsurface simulation techniques, for instance finite element models used to analyse and predict movements as triggered by the production of oil and gas.

JOA has recently demonstrated at a big industry exhibition a JewelSuite set-up that combines high-performance cluster hardware with smart software solutions, reducing the simulation time for field-wide Geomechanics by orders of magnitude.

About JOA

JOA is based in Delft, Netherlands, and provides support from offices in Houston, Moscow, Jakarta, Aberdeen and Stavanger.

The reservoir engineering solutions are built in Albuquerque (New Mexico) where all new code is also exhaustively tested.

The company was founded in 1999, originally building bespoke software for Shell. See www.jewelsuite.com

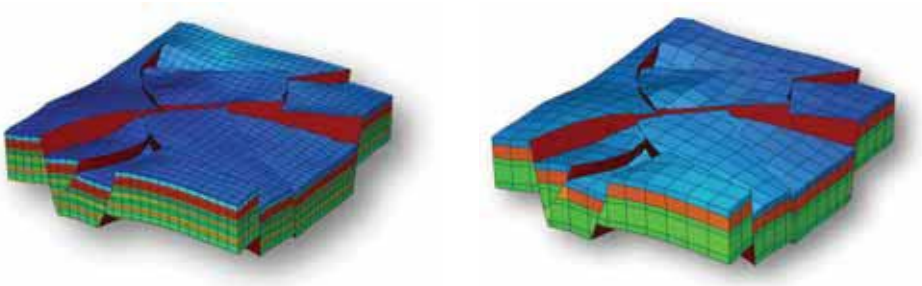

Figure 3- It is fairly easy to simplify your detailed geological model (left) to a simpler model you can use for reservoir simulation (right).