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OptaSense Well Interference Profiling Service

Utilize DAS to Assess Production and Determine Well Interconnectivity

Fiber optics measurements are influenced by various physical processes in the well, including temperature, flow, pressure changes, fracture movement and rock shifting. As such it enables the examination of well and reservoir dynamics from different vantage points. This creates an integrated physics approach to better understand and quantify production in complex reservoirs.

Production monitoring and Well Interference with Distributed Sensing determines inflow or injection profiles along the whole completion. Production monitoring with fiber enables a direct look at every aspect of the completed zone. In complex multiwell pads the OptaSense Well Interference Profiling Service determines changes in production that are associated to nearby well and reservoir influences.

When developing oil and gas reservoirs, it is preferred to have individual wells produce from their own, isolated drainage regions. This is done to keep the pressure as high as possible for as long as possible to optimize total production and hydrocarbon recovery. In reality, this is rarely the case as it is easy for two or more wells to influence each other.

Communication between adjacent wells, be they separated laterally or vertical, is frequently encountered in multi-stage fractured shale reservoirs. Both natural and induced fracture networks have the potential to create interconnectivity paths between the wells.

To minimize the influence of interconnectivity, it is important to know where these connections occur, how many there are, which reservoir layers are affected, and if it is due to the completion efforts, e.g., fracture shape and reach, or the preexisting reservoir conditions.

Interference testing is one of the most common methods for testing the connectivity in the reservoir. Traditional methods have relied solely on measuring pressure pulses in an observation well

OptaSense Advantages

- Identify reservoir communication between wells
- Determine distributed production profiles
- Optimize completion design and well placement from production data
- Multi-physics analysis of well/ reservoir interactions
- Permanent or wireline fiber monitoring solutions

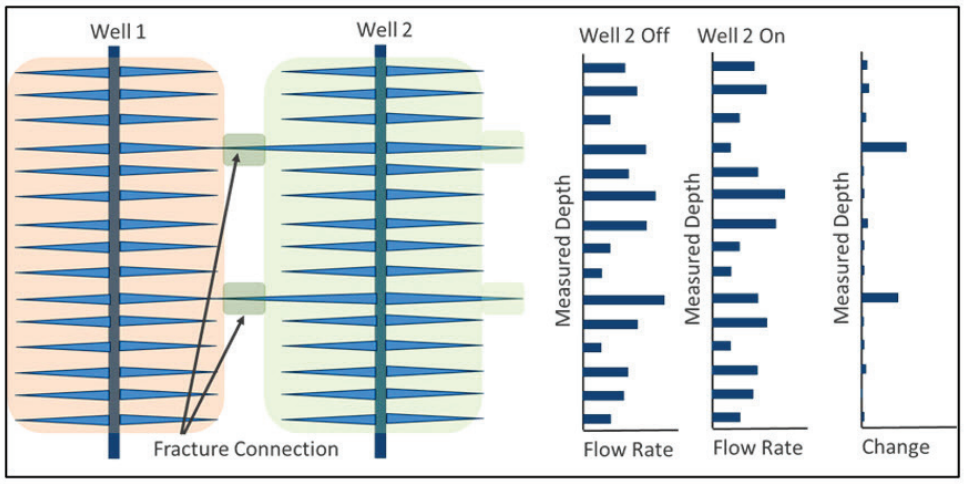

Figure 1 - Well interference between two nearby wells due to fracture network connections.

during shut-in or start-up of an injection or producing well. Connectivity is determined based on the strength of the pulse and the timing between pulse generation and response. While this method can indicate that two wells are connected, it does fail to determine which layers or stages are connected. Additionally, it requires extended shut-in times of the reservoir in that region, resulting in lost production.

The OptaSense Solution

The Well Interference Profiling Service utilizes production profiling via distributed fiber-optics production profiling. The fiber captures acoustic, strain and thermal "vibrations" occurring when the fluid enters the wellbore through the perforations. Those are interpreted into a distributed inflow profile along the completion.

By taking production profiles at various points in time following certain events, such as start-ups or shut-ins of the surrounding wells, production profiles can be compared, and the changes characterized and quantified. Based on the executed test program, the analysis reveals reservoir connections between individual wells and the fibered well on a cluster or stage level (Figure 1).

How It Works

With the Well Interference Profiling Service, a fiber cable is run from the surface to the toe of the well. The fiber can be deployed in the well behind casing, on production tubing, or via wireline or other retrievable methods that can be more cost effective. A laser pulse is injected into the fiber at the surface and the light travels down along the fiber detecting inflow signals along the well. The magnitude of the inflow signals and their location identify and quantify production zones along the wellbore. The high sensitivity acoustics, strain and temperature signals makes them robust measurements that are representative of inflow conditions since they do not have to disturb well conditions.

Well interference testing uses the production profiles generated at different times during the testing program and compares them to determine connections between the wells. The testing program usually consists of different wells coming online or shutting down at different time intervals while a fiber-optic equipped well is being produced continuously. Testing programs can be optimized to minimize any production interruptions.

During the Well Interference Profiling Service a fibered well is used to monitor various offset locations, it also includes a nearby test well that is suspected of "interfering" with the production region of the fibered well. To determine that 1) they are connected, and 2) where exactly they are connected, the fibered well is kept flowing steady and continuously. An inflow production profile is obtained and then the nearby test well is restarted. After stabilization, another profile is taken on the fibered well and those profiles are the compared to determine changes in inflow, magnitudes, and locations. The results are interpreted, and the connected clusters identified revealing well to well communication.

Delivered Value

The fiber-optic based production profile measurement, provided by the OptaSense Well Interference Profling Service, can quantify production, detect well inflow regions in the profiles and identify well interference locations accurately down to the individual cluster level. The accuracy is superior to pressure-based well interference testing. More importantly it provides full wellbore spatial illumination for better understanding of the reservoir dynamics. This delivers two products as one, inflow profiling and well connectivity determination respectively, with minimal lost production during testing, quick mobilization and execution, as well as relative short testing times.

For more information, please contact your OptaSense representative or visit www.optasense.com/oilfield services.

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