Dynamic Response in a Pipe String during Drop-Catch in a Wellbore

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***Abstract**: In field operations, during rapid deceleration of pipe (simulated by drop-catch process) or slack-off stop process, significant dynamic effects can occur. The dynamic event can amplify the load on the pipe string, and the amplified load can break a weak thread. It is necessary to understand the mechanics of this dynamic event, and thus, provide guidelines or directions for safe design and operation of the pipe string. An analysis procedure using FEA, which involves fluid-pipe interaction, has been established for this study. It shows that fluid viscosity is a very important parameter in determining whether a given pipe string with a weak thread will be safe or not under a given operating procedure.*

***Keywords:** Dynamics, Fluid Structure Interaction, Pipe string, Wave, FEA, Viscosity*

1. Background

When operating on a pipe string in the field, an operator may decelerate a fast moving pipe in too short a time. For a very long pipe string, the dynamic effect in this process is significant, and load on a thread can be much larger than the pipe weight (in fluid) below the thread, i.e. the load is amplified. When a weak thread, e.g. 60% thread, is near the top of the string, the thread may fail in this process. This failure due to rapid deceleration at a weak thread has been a thorny issue to design engineers for some time. It is necessary to understand the mechanics of this dynamic event, and thus, provide guidelines or directions for safe design and operation of the pipe string. Here, a drop-catch process is used to simulate the fast deceleration process. The drop-catch process is designed to allow the pipe to drop freely, and then, to catch it to achieve the rapid deceleration effect in a simple way.

Questions of practical importance include: 1) for given environment (well bore size, drill-in fluid) and operation condition (e.g. pipe is dropped 1 ft before being caught), how long the pipe string can be below a weak thread 2) Is the drop height important? (i.e., Is the pipe velocity important?) 3) How does the fluid in the wellbore affect the operation? 4) Is the size of the wellbore an important parameter?