Development of an Elastic / Plastic Yielding Envelope of Pipes Pulling/Running Through Curved Wellbore Section

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Abstract

In recent years, horizontal drilling became more efficient than vertical drilling. However, oil industry has been experiencing frequent failures of tubular when pulling/running through medium to high curvature wellbores. Causes of such failures may be related to excessive bending stresses caused by severe doglegs and drag forces. Therefore, various models such as "soft string" and "weighted cable" have been developed in the past to understand the behaviour of drill pipes pushed or pulled from curved sections. These models did not take into consideration the bending stresses caused by local severe doglegs and drag forces. Moreover, none of these models generates operating envelops that indicate how safe the operation of running/pulling different API drill pipes for various field conditions. The present work describes the major steps in developing a two dimensional mathematical model based on Daring and Ahlers model which incorporates various field parameters that affect drill pipe in the buildup section. Moreover, Daring and Ahlers model did not outline an operating failure envelop of potential API drill pipes used in the field. Hence, this study aims at establishing elastic/plastic envelops in order to provide field engineers with a good knowledge of the effect of running and pulling forces on drill pipes. It also enables field engineers to select appropriate drill pipes according to operating field conditions in order to avoid any unexpected failure. It is found that in most of the cases drillpipes tend to fail while been pulled or pushed through curved sections for most of field conditions. The developed model is capable of studying the effects of vertical force and formation roughness in both low and high curvature wellbores whereas the cable and soft string models are limited to study the effects of aforesaid field parameters in low curvature wellbores. In addition, the other potential factors such as the contact forces between the drillpipes and the walls of the wellbore are considered in the developed models and ignored in the soft and cable models.