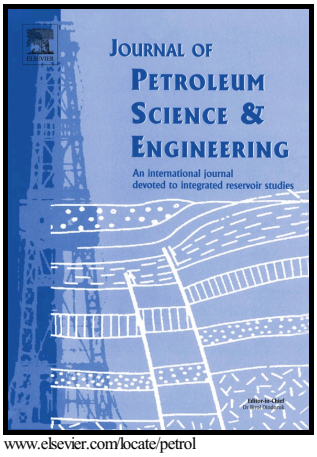

www.elsevier.com/locate/petrol

Simplified Surge Pressure Model for Yield Power Law Fluid in Eccentric Annuli

Ming Tang, Ramadan Ahmed, Ruchir Srivastav, Shiming He

PII: S0920-4105(16)30207-8
DOI: http://dx.doi.org/10.1016/j.petrol.2016.05.038
Reference: PETROL3481

To appear in: *Journal of Petroleum Science and Engineering*

Received date: 29 March 2016
Revised date: 18 May 2016
Accepted date: 26 May 2016

Cite this article as: Ming Tang, Ramadan Ahmed, Ruchir Srivastav and Shiming He, Simplified Surge Pressure Model for Yield Power Law Fluid in Eccentric Annuli, *Journal of Petroleum Science and Engineering* http://dx.doi.org/10.1016/j.petrol.2016.05.038

Simplified Surge Pressure Model for Yield Power Law Fluid in Eccentric Annuli

Ming Tang[a,b], Ramadan Ahmed[b,1], Ruchir Srivastav[b,2], Shiming He[a]

[a] State Key Laboratory of Oil and Gas Reservoir Geology and Exploitation, Southwest Petroleum University, Chengdu, PR China

[b] Mewbourne School of Petroleum and Geological Engineering, University of Oklahoma, OK, USA

Abstract

Axial movement of drillstring during drilling operations causes downhole pressure variations, which are commonly known as surge and swab pressures. This paper presents a new eccentric annulus surge pressure (EASP) model for yield power law (YPL) fluid. To develop the model, flow in eccentric annulus was investigated using computational fluid dynamics (CFD) technique (ANSYS Fluent). CFD simulations were conducted varying fluid rheological parameters, tripping speed and annular geometry. Simulation results are analyzed considering surge pressure ratio (i.e. ratio of surge pressure in eccentric annulus to that of concentric annulus) as a parameter for quantifying effect of eccentricity on surge pressure. Surge pressure ratio (SPR) is found to be very sensitive to fluid behavior index and annular eccentricity and diameter ratio. In addition to the CFD studies, small-scale laboratory experiments were conducted to validate accuracy of the EASP model. Results show that the model accurately (i.e. maximum error of ±5%) and conveniently predicts surge and swab pressures for YPL (Herschel Buckley) fluid in eccentric annulus without requiring complex numerical procedures. The model is valid for wide ranges of diameter ratio ($0.2 \leq K_d \leq 0.8$), eccentricity ($0 \leq \varepsilon \leq 0.9$) and fluid behavior index ($0.2 \leq n \leq 1$).

Keywords: Herschel Buckley fluid; Surge pressure; Eccentric annuli; Modeling; CFD, Tripping speed

[1] Corresponding author. Tel.: +1(405)325-0745; Fax: +1(405)325-7477. E-mail address: r.ahmed@ou.edu

[2] Currently with Superior Energy Services