

# About Multi-parametric Analysis of Drill String Vibrations

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**Abstract** Coupled flexural-torsional vibrations of drill strings are subject to multi-parametric analysis. A drill string is modelled as a thin elastic beam taking into account the effect of primary static deformation induced by the prescribed compressional force and twisting moment. The appropriately normalized ratio of the two latter quantities along with dimensionless vibration frequency and beam relative thickness are assumed to be the main problem parameters. Three distinct dynamic regimes are determined. Two of them correspond to predominantly torsional or flexural vibrations. The third regime is not widely known. It is specific of the primary static deformation, caused by the aforementioned twisting moment. Simplified limiting equations are formulated for each of the regimes. Associated approximate dispersion relations are compared with the exact dispersion relation corresponding to the original problem. The developed methodology may be useful for qualitative interpretation of numerical and experimental data related to drill string modelling.

**Keywords** Drill string · Vibrations · Flexural-torsional vibrations · Elastic beam · Multi-parametric analysis

## 1 Introduction

Nowadays the main sources of energy are oil and gas. The demanded growth of volume of oil and gas production conducts to intensity of development of petroleum deposits. Therefore, oil and gas exploration represents scientific and practical

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