Planning of an Offshore Well Plugging Campaign: A Vehicle Routing Approach

Steffen Bakker[*1]

[1]Norwegian University of Science and Technology - NTNU (NORWAY) (NTNU) – Alfred Getz' vei 3, 7034 Trondheim, Norway

Abstract

When a petroleum well no longer serves its purpose, the operator is required to perform plug and abandonment (P
A) operations on the well to avoid contamination of reservoir fluids. An increasing number of offshore wells need to be P
A'd in the near future, and the costs of these operations are substantial. Research on planning methods in order to allocate the required resources to perform these operations in a cost-efficient manner is therefore essential. We take a tactical planning level perspective and consider a set of wells that have to be P&A'd, making use of different vessels. The plugging of each well consists of the execution of a set of operations that has to be performed in a strict sequence. We use an optimisation approach and propose a mixed integer linear programming model formulation based on an extension of the uncapacitated vehicle routing problem with time windows with a heterogeneous fleet of vessels, precedence and non-concurrence constraints. The problem minimises permanent P&A costs by scheduling P&A operations and assigning routes to vessels. We refer to such a problem as a P&A campaign. We are currently able to solve instances with approximately 20 wells to optimality. Making use of a realistic case study, based on real-life data, we show that our approach may lead to significant cost savings compared to traditional planning methods.

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[*]Speaker