Contingency Management

The Drilling Systems Automation Roadmap Contingency Management section is still a work in progress. Contingency management offers a methodology to develop a robustness in automated systems when uncertainties or emergencies significantly change the environment of operation.

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Introduction

Automated Contingency Management (ACM) is a developing technology application aimed at managing the health of the whole system.[1] Fully applied, it allows operators to confidently and autonomously adapt to fault conditions with the goal of achieving mission objectives. In well construction, this is a significant technical challenge that relies on the correct performance of several supporting technologies as well as the ACM system itself. Although it is not a panacea for recovery from operational incidents, it does provide a means for constructive thinking about methods of recovery in automated systems. As drilling systems automation (DSA) progresses toward high levels of automation and adopts more autonomous systems of interest (sub systems), the need to adopt and the value of ACM practices will increase. This section of the roadmap is currently not developed and is a place holder for future content development as this practice becomes more relevant.

Functional Description

ACM technologies include sensors and anomaly detection, diagnostics and prognostic algorithms, reasoning algorithms, and the control software and hardware required to carry out ACM. ACM systems provide a framework to accommodate these technologies and leads to the design of high confidence drilling systems with the robust fault accommodation and adaptive operation reconfiguration necessary for reduced drilling risk and uncertainty. The purpose of ACM is to ensure safe, deterministic, trustable and deployable autonomy. Examples studied have been primarily in military, commercial aviation and aerospace operations. In military and commercial aviation, the examples include midair collisions, missile attack and engine failure.

Performance Targets

Given an unstable state of the system and subject to predefined system constraints, the goal of ACM is to create the optimal action sequence that brings the drilling system to the desired state with a minimal cost and the highest probability of success. The drilling system needs to understand when it is in trouble and to then activate mechanisms that rapidly learn how to escape the trouble situation and return to normal and stable operation. The system needs to provide full and continuous situational awareness to supervisory operators actively involved with the system. It must know fully the current state of all attributes of the drilling systems automation, including those defined by the control system and those measured by well state and other non-controlled parameters.

The ACM needs to detect fault conditions across the whole spectrum of DSA, attempt corrections and undertake mitigation actions to return the degraded operational state to a normal operational state. In the event the abnormalities fall outside the scope of the programmed systems, the ACM must return the operation to a pre-defined safe state and await further human input.

Current Situation

Automated contingency management is not applied in drilling operations. The human in the loop, based on training and experience, is usually the contingency management driver.

Problem Statement

Highly automated and autonomous systems may fail to act as intended when fault conditions in the system, the machinery or wellbore occur.

Way Ahead

This section is intentionally blank.

References

1. NASA Automated Contingency Management, https://ti.arc.nasa.gov/tech/dash/groups/pcoe/automated-contingency-management/

