Design and testing of a heat transfer sensor for well exploration tools - DTU Orbit
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**Design and testing of a heat transfer sensor for well exploration tools**

The exploration of oil, gas, and geothermal wells is moving towards increasingly harsher downhole environments, requiring more and more advanced drilling and intervention tools. The high downhole temperatures threaten the correct functionality of intervention equipment and of standard downhole electronics, which cannot withstand temperatures above 150°C for an extended period of time. Thermal management of downhole electronics therefore requires critical and accurate knowledge of the thermal interaction between the downhole tools and the wellbore environment for correct tool design, intervention planning and operation. In this work, we present the design, modelling and testing of a sensor for downhole tools that can determine the heat transfer rate between the tool and the harsh downhole environment. An experimental flow loop was used to simulate the interaction between the sensor and the well fluid, and to calibrate the sensor in the range of heat transfer coefficients 0–1000W/m²K. Good agreement between model predictions and experimental results was obtained with average and maximum errors of ~3% and ~10%, respectively. A sensitivity of up to 8.7mV/(W/m²K) was measured and a response time of about 11s was obtained over a 25% change in the fluid velocity.

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