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Titel des Beitrags:
An Approach for Safe and Efficient Human-Robot Collaboration

Abstract:
In today's working cells, human operator and robot are strictly separated in space and/or time. If integrated, human operators could do intelligent monitoring tasks or even actively participate in the process. Since the behavior of the operator in such human-robot collaboration (HRC) scenarios is not exactly known a priori, the system has to cope with considerably changing conditions. The inclusion of humans into the production process leads to high demands for employed safety measures. Collaboration (and interaction) between the plant and human operators can possibly lead to injuries, if appropriate measures are missing. Obviously, the most important requirement for the development of safety concepts is therefore the minimization of critical incident probability, in which the human operator is harmed. This paper proposes a two-level approach in which (a) the Optimizing Strategic Control (OSC) increases the availability and reliability based on learning principles for derivation of control strategies (non safety-critical) and (b) the independent Fail-Safe Control (FSC) ensures the overall safety of the system (safety-critical). Systems that adapt to changing conditions can act as an enabler for a more efficient and cost-effective production of different product types and batch sizes. An architecture for human-robot collaboration is proposed in which the environment of the robot is constantly monitored. This allows for the prediction of the operator's future behavior and to gear the robot behavior towards efficiency of production without harming the overall safety of the system.

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