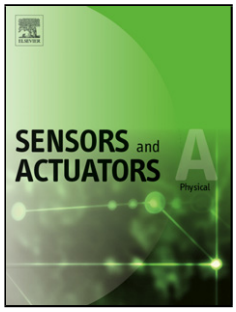

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Fault-tolerant strategy and experimental study on compliance assembly of a redundant parallel six-component force sensor

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Highlights

- A novel idea of redundant fault-tolerant is introduced into the sensor structure design and force mapping model
- Fault-tolerant calibration matrix and key performances are obtained by experiments and data analysis.
- Fault-tolerant strategy including fault diagnosis strategy and fault identification strategy of the sensor are presented.
- Spline shaft assembly strategy based on redundant parallel six-axis force sensor is presented.
- The spline shaft assembly experiment with sensor failure is carried out in order to prove fault-tolerant strategy.

Abstract

In this paper, the structure model and comprehensive measuring model of a redundant parallel six-component force sensor is given. In order to proof the fault-tolerant characteristic, the sensor's work strategy is analyzed, the fault diagnosis strategy and fault identification strategy of the sensor are presented. Then its non-fault and fault-tolerant calibration mathematic model are established respectively. Based on the calibration model, the fault-tolerant calibration test, the fault-tolerant calibration matrix and error matrix are obtained. Aiming at the combination of practical industrial work and redundant parallel six-component force sensor, the spline shaft assembly is chosen, its force model and assembly strategy is analyzed. The testing platform of assembly experiment is established. Finally, the experiment with sensor failure and the experiment without sensor failure are both done, which shows good results in six-component force measurement and fault-tolerant characteristic.

Keywords: redundant parallel six-component force sensor; fault-tolerant calibration; fault-tolerant strategy; spline shaft assembly; assembly strategy