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The ELT primary mirror fault detection, isolation, and recovery software

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The 39m diameter primary mirror of the ESO Extremely Large Telescope, currently under construction at Cerro Armazones in Chile, is composed of 798 hexagonal segments. Each segment is equipped with several sensors and actuators to measure and adjust its position. The control algorithm uses 24000 I/O points, distributed over 1195 square meters, to dynamically maintain the alignment and the shape of the mirror. The reliability of this large number of devices is improved by the introduction of a failure detection, isolation, and recovery strategy. The main goal of the FDIR strategy is to enable the control loop to continue working even in case of failures by identifying and masking faulty devices in real-time and avoid failure propagation. This paper provides an overview of the system, summarizes the main availability requirements, and illustrates how the FDIR software has been designed, implemented, and tested. The detection and isolation of failing edge sensor devices, responsible for measuring the difference in piston, shear, and gap between adjacent segments, is taken as running example. Advantages and limitations of the presented design are summarized in the conclusions.

Footnotes

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