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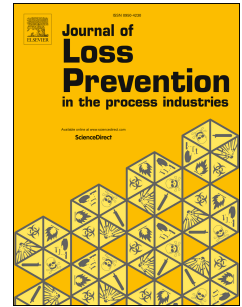
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Reallocation Index Based Sensor Network Design

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Abstract

Recently, the concept of reallocation index has been proposed in literature for sensor network design. In this work, we extend this concept to enable base case design of sensor networks for various criteria. Reallocation index indicates the possibilities of future reallocation of sensors while retrofitting an existing design. Higher value of reallocation index indicates more possibilities of reallocation of sensors that can be more cost effective than adding (upgrade) new sensors. Reallocation index is maximized as an additional objective while performing base case design of a sensor network. The resulting design is then optimal not only for the base case, but also ensures that any future upgrade and reallocation can be carried out effectively with less cost. The proposed sensor network design approach is illustrated on three types of sensor network design problems, namely selecting variables to be measured to ensure: (i) robust design for reliable fault diagnosis, (ii) observability of process variables after a change in the process layout, and (iii) estimation of important process variables with low uncertainty. For each case, simulation based experiments are performed to demonstrate the utility of base case designs obtained after maximization of reallocation index.

Keywords: Reallocation and upgrade; optimization; robust fault diagnosis; observability; estimation variance;

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