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On-line fault detection in uncertain nonlinear systems using diagnostic observers: A survey.
(English) [Zbl 0822.93046](#)
Int. J. Syst. Sci. 25, No. 12, 2129-2154 (1994).

The paper is a review of an observer-based approach to fault detection and isolation (FDI) in nonlinear time-varying systems and is devoted mainly to a detailed discussion of a dozen or so papers by the author and his coworkers. The main line of reasoning is to extend the result on the analytical redundancy approach for linear systems with unknown input to nonlinear and adaptive strategies. This approach enables decoupling between the different faults and ensures robustness with respect to modeling uncertainties or disturbances. The author claims that the observer-based approach is general after he has demonstrated its equivalence with the parity space approach. The paper addresses both steps of FDI, i.e. generation of a residual that reflects the fault and evaluation of the residuals with the aid of a decision-maker. Concerning the former problem, several observer-based robust methods are discussed. For solving the latter problem, besides reviewing the most important existing methods, a new proposal for an adaptive residual evaluation is reported. The paper presents many interesting ideas and solutions but the major problem is that the author devotes almost all of the review to his own papers. In my opinion, a review should summarize all important results in a specific area. By comparing these results, a conclusion could be drawn about the strengths and weaknesses of the various techniques. This is not the case here.

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MSC:

- [93C41](#) Control/observation systems with incomplete information
- [93B07](#) Observability
- [93C10](#) Nonlinear systems in control theory
- [93C99](#) Model systems in control theory
- [93C95](#) Application models in control theory
- [90B25](#) Reliability, availability, maintenance, inspection in operations research
- [93-02](#) Research exposition (monographs, survey articles) pertaining to systems and control theory
- [93E10](#) Estimation and detection in stochastic control theory

Cited in **14** Documents

Keywords:

[time-dependent](#)

Full Text: [DOI](#)

References:

- [1] BARSCHDORFF, D., 1990, Adaptive Echtzeitverfahren als Hilfsmittel der Fehlerdiagnose, VDI-Berichte 854 (Baden-Baden, Germany. GMA-Aussprachetag), pp. 1 – 19.
- [2] DOI: [10.1016/0005-1098\(88\)90073-8](#) · [Zbl 0653.93051](#) · [doi:10.1016/0005-1098\(88\)90073-8](#)
- [3] DOI: [10.1109/9.1273](#) · [Zbl 0676.93037](#) · [doi:10.1109/9.1273](#)
- [4] DOI: [10.1080/00207178808906138](#) · [Zbl 0648.93022](#) · [doi:10.1080/00207178808906138](#)
- [5] BRUNET J., Detection et Diagnostic de Pannes, Approche par Modelisation (1990)
- [6] CESARI L., Asymptotic Behavior Stability Problems in Ordinary Differential Equations (1971)
- [7] DOI: [10.1109/TAES.1978.308607](#) · [doi:10.1109/TAES.1978.308607](#)
- [8] CLARK R. N., Fault Diagnosis in Dynamic Systems, Theory and Application (1989)
- [9] DOI: [10.1016/0167-6911\(90\)90094-B](#) · [Zbl 0703.93068](#) · [doi:10.1016/0167-6911\(90\)90094-B](#)
- [10] DOI: [10.1016/0167-6911\(90\)90104-3](#) · [Zbl 0724.93009](#) · [doi:10.1016/0167-6911\(90\)90104-3](#)
- [11] EMAMI-NAEINI, A., 1988, Robust detection, isolation and accomodation for sensor failures. NASA Contractor Report, No. CR 174825.

- [12] FRANK , P. M. , 1986 ,System Fault Diagnostics, Reliability and Related Knowledge-Based Approaches, edited by S. Tzafestas, M. Singh and G. Schmidt , Vol. 1 (Dordrecht Reidel), pp. 35 – 98 ; 1987, Proc. 10th IF AC World Congress, Munich, Germany, Vol. 3, pp. 63-68; 1990, Automatica, 26, 450; 1991, Enhancement of robustness in observer-based fault detection. Proc. IFAC/IMACS Symposium SAFEPROCESS '91, Baden-Baden, Germany ,
- [13] FRANK P. M., Fault Diagnosis in Dynamic Systems, Theory and Application (1989)
- [14] GERTLER J., ProcIFAC/IMACS Symp. SAFEPROCESS '91 pp 9– (1991)
- [15] HHNGY D., Proc. IF AC Workshop on Fault Detection and Safety in Chemical Plants pp 153– (1986)
- [16] HOWELL , J. , 1991 , Model-based fault diagnosis in information-poor processes . Ph.D. thesis , University of Glasgow , U.K
- [17] ISERMANN R., Proc. IF AC/1 MACS Symp. SAFEPROCESS '91 pp 121– (1991)
- [18] ISIDORI A., Nonlinear Control Systems (1989) · [Zbl 0693.93046](#)
- [19] DOI: 10.1109/9.58536 · [Zbl 0729.93016](#) · [doi:10.1109/9.58536](#)
- [20] PATTON R. J., Proc. IFAC/IMACS Symp. SAFEPROCESS '91 pp 239– (1991)
- [21] PATTON R. J., Fault Diagnosis in DynamicSystems, TheoryApplication (1989)
- [22] PATTON R. J., Fault Diagnosis in Dynamic Systems, Theory and Application (1989)
- [23] SAUTER D., Contribution a l'etude des methodes de detection de rupture de model (1991)
- [24] SELJGER R., Proc.IFAC/IMACS Symp. SAFEPROCESS '91 pp 313– (1991)
- [25] VISWANADHAM N., Control Theory and Advanced Technology 3 pp 91– (1987)
- [26] WAINON E., Proc. IFAC/IMACS Symp. SAFEPROCESS'91 pp 319– (1991)
- [27] WALKER B. K., Fault Diagnosis in Dynamic Systems Theory and Application (1989)
- [28] WUENNENBERG J., Fortschrittsberichte 8 pp 222– (1990)
- [29] WUENNENBERG J., System Fault Diagnostics, Reliability and Related Knowledge-Based Approaches (1986)
- [30] ZEITZ M., Fortschrittsberichte 8 pp 27–

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