Generating Directional Residuals with Dynamic Parity Relations*

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Abstract—It is shown how diagnostic residuals, which exhibit directional properties at all times in response to an arbitrary mix of input and output faults, can be generated using dynamic parity relations. The parity relations are applied directly to the observables of the monitored plant; the design relies on the plant's dynamic input–output model. This residual generator can be made computationally polynomial (moving average) by including the invariant zero polynomial of the fault system in the specified fault responses. The polynomial design yields moving average noise transfer as well. White noise transfer and disturbance decoupling are achieved by extending the response specification. The parity relation approach is compared with the traditional detection filter design, and is shown to be more straightforward and have milder existence conditions; if subjected to the same specification, the two approaches yield identical residual generators.