Advanced Sensor Diagnostics in Nuclear Power Plant Applications

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Sensor degradation occurs routinely during nuclear power plant operation and can contribute to reduced power production and less efficient plant operation. Mechanisms include drift of sensor electronics and mechanical components, fouling and erosion of flow meter orifice plates, and general degradation of thermocouples. One solution to this problem is the use of higher quality instrumentation and of physical redundancy. This, however, increases plant cost and does not address the degradation problem in a fundamental way. An alternative approach is to use signal processing algorithms to detect a degraded sensor and to construct a replacement value using an analytic basis. This can include combining an understanding of the failure mechanisms and modeling them with an understanding of the plant physics that link disparate sensors whose values are seemingly unrelated but are in fact correlated. Then potentially an economic savings can be realized by postponing recalibration, repair, or replacement to the time of the next scheduled plant outage.