Optimized prognostics approach on early anomaly detection methodology for small modular reactors

Sanghoon Bae[1], Jungtaek Kim[1]

[1]Advanced I&C Research Lab, Korea Atomic Energy Research Institute, Republic of Korea

Small modular reactors will be a critical way to meet net zero power generation and carbon free energy transition goals. For some reason, nuclear power has sufficient capability of flexibility to fluctuating power demands in case other sources of renewable energy like solar and wind power cannot help being as constant. Therefore, this small modular reactor (SMR) development is considered mandatory where nuclear power can be generated from each unit of smaller reactors in particular off-grid or remote area. As operation and maintenance (O&M) costs of current nuclear power plant is getting higher, a distributed fleet is more imposing extra cost if remote monitoring and maintenance is not available. In order to economize the power plant cost, prognostics and health management (PHM) using proactive maintenance for early warning and anomaly detection with high reliability can be employed in an active manner. In particular, prognostics as well as diagnostics are seriously considered in the nuclear discipline so that wireless technology with on-line calibration are implemented. Today several monitoring solutions are developed on component and system level to prevent anticipated failure modes. However, this is limited to a system-wise monitoring hence specific targeted analytics can be a key factor. This paper would suggest optimized prognostics approach on early anomaly detection methodology for SMRs that has been widely under discussion in nuclear fields. In addition, several expected challenging issues on SMRs will be addressed where the suggested approach will be brought in.